

Tactical Control System (TCS)

System/Subsystem Design Description (SSDD)



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Chapter 1 Scope

1.1 Identification

This TACTICAL CONTROL SYSTEM (TCS) - SYSTEM / SUBSYSTEM DESIGN DESCRIPTION (SSDD) VERSION 1.0 describes the system or subsystem wide design and architectural design decisions for the Tactical Control System as set forth by the OPERATIONAL REQUIREMENTS DOCUMENT (ORD) FOR THE UNMANNED AERIAL VEHICLE (UAV) TACTICAL CONTROL SYSTEM (TCS) - VERSION 5.0, and the TCS SYSTEM / SUBSYSTEM SPECIFICATION (SSS) - VERSION 1.0 (TCS 102). This SSDD will be supplemented by Interface Design Descriptions (IDDs) Data Item Description DI-IPSC-81436. Requirements pertaining to the TCS external interfaces will be published in separate Interface Requirements Specifications (IRSs) which will be incorporated into a combined IRS/IDD document. The SSDD is published In Accordance With (IAW) a tailored Data Item Description DI-IPSC-81432, dated 941205. This SSDD will be revised at the conclusion of the Program Definition and Risk Reduction period (Phase I) of the TCS program based on lessons, insights, and results of the demonstrations conducted during the risk reduction program, and will be re-issued as the TCS SSDD.

This SSDD identifies top level design requirements for a common, modular and scaleable control system for tactical UAVs, which will provide war fighters with a scaleable command, control, communications and data dissemination system for tactical UAVs. This SSDD, with its associated IRSs/IDDs, will be used as a basis for further system development. Throughout the SSDD the term “system” may be interpreted to mean “subsystem” as appropriate.

1.2 System Overview

The purpose of the TCS is to provide the military services with a single command, control, data receipt, data processing, data export and dissemination system that is interoperable with the family of all present and future tactical unmanned aerial vehicles. These UAVs shall include the Tactical Unmanned Aerial Vehicle (TUAV) and the Medium Altitude Endurance (MAE) UAV (henceforth referred to as Outrider and Predator, respectively), their associated payloads, and other network communication systems. TCS will also be capable of receiving and processing information from High Altitude Endurance (HAE) UAVs, their associated payloads, future development UAVs and payloads. Further discussion on the General Nature of the System is contained in paragraphs 1.2.1 through 1.2.4 below.

During Phase 1 of the TCS development program (see paragraph 1.2.1), Operations and Maintenance of the TCS will be a government responsibility shared between Naval Surface Warfare Center-Dahlgren Division, Dahlgren, Virginia, and the US Army's Joint Test Center/System Integration Laboratory, Redstone Arsenal, Alabama. The specific details and assignment of maintenance responsibility during Phase 2 is still under development in evolving the TCS Acquisition Strategy.

The Defense Airborne Reconnaissance Office (DARO) is the Secretary of Defense level resource sponsor and oversight monitor for the TCS program. The acquirer is to be determined prior to Phase III (Production, Fielding/Deployment, Operational Support and Retrofit). The user includes all Four Military Services. The Developer is the TCS Program Manager (PM-TCS) in the Navy Program Executive Office (PEO) for Cruise Missiles and Unmanned Aerial Vehicles. Engineering support is provided the Naval Surface Warfare Center (NSWC) Dahlgren Division (DD), the Army's Joint Technology Center/Systems Integration Laboratory (JTC/SIL), the Army Missile Command (MICOM) and other field activities and

support offices.

Operating sites will initially include land based and sea based configurations. During the Phase I (Program Definition and Risk Reduction) three fieldable TCS prototypes (one ship based, two land based) will be developed over a 24 month period. During this phase Predator and Outrider air vehicles and payloads will be integrated with TCS common core functions

1.2.1 TCS Program, Phases, and UAV Interaction

Design and development of the TCS will be conducted in two phases. Phase I is defined as the Program Definition and Risk Reduction phase, and Phase 2 is defined as the Engineering and Manufacturing Development phase in accordance with Department Of Defense Instruction (DODI) - 5000.2R. Phase II will commence TCS Low Rate Initial Production (LRIP). This SSDD focuses primarily on the Phase I and Phase II efforts and will be revised prior to Phase III based on lessons learned during development and Advanced Warfighting Experiments.

Phase 1 will be a 24 month period and will demonstrate Level 1 through Level 5 interaction (as defined below) in an incremental and evolutionary strategy as described in accordance with MIL-STD-498. The five discrete levels of multiple UAV interaction to be provided by the TCS are:

Level 1 - receipt and transmission of secondary payload imagery and/or data;

Level 2 - direct receipt of payload data/imagery;

Level 3 - UAV payload control and direct receipt of payload data/imagery;

Level 4 - control of the UAV, less launch and recovery, in addition to all functionality of Levels 1 through 3; and,

Level 5 - full functionality and control of the UAV from launch to recovery.

1.2.2 Tactical Control System

The TCS is a software intensive program to provide the warfighter with a scaleable and modular capability to operate UAVs on existing computer systems and interface for dissemination with current and future Command, Control, Communication, Computer, and Intelligence (C4I) processing systems. The TCS consists of the software, software-related hardware and the extra ground support hardware necessary for the control of the TUAV, and the MAE UAV, and future tactical UAVs. The TCS will also provide connectivity to specifically identified C4I systems. TCS will have the objective capability of receiving, process and disseminate HAE UAV payload information. TCS will provide a common Human-Computer Interface (HCI) for tactical airborne platforms to simplify user operations, training, and facilitate seamless integration into the Services' Joint C4I infrastructure across all levels of interaction.

1.2.2.1 Software

The major focus of the TCS program is software. The software will provide the UAV operator the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, limited data exploitation, and data dissemination. The software

will provide a high resolution computer generated graphics user interface that enables a UAV operator trained on one system to control different types of UAVs or UAV payloads with a minimum of additional training. The TCS will operate in an open architecture and will be capable of hosting on computers that are typically supported by the using Service. Software developed under this program will be non-proprietary and compliant with the Defense Information Infrastructure / Common Operating Environment. Additionally, this TCS software shall become the architectural standard for all future tactical UAVs. To the extent possible, the TCS will use standard Department of Defense (DoD) software components to achieve commonality. TCS will provide software portability, scaleable functionality, and support for operational configurations tailored to the users' needs.

1.2.2.2 Hardware

To the extent possible, the TCS will use standard DoD components in order to achieve commonality. The TCS will use the computing hardware specified by the service specific procurement contracts. The individual armed services will identify TCS computing hardware, the desired level of TCS functionality, the battlefield C4I connectivity, and the particular type of air vehicle and payloads to be operated depending upon the deployment concept and area of operations. TCS hardware must be capable of being scaled or modularized to meet varying Service needs. TCS hardware will permit long range communications from one TCS to another, data storage expansion, access to other computers to share in processing capability, and multiple external peripherals.

1.2.3 Integration with Joint C4I Systems

TCS supports direct connectivity to standard DoD tactical (Very High Frequency (VHF), Ultra High Frequency (UHF), VHF/UHF, and High Frequency (HF)) radios, Mobile Subscriber Equipment (MSE), and military and commercial satellite communications (SATCOM). TCS integration with C4I systems will be accomplished through development of interfaces that permit information exchange between the TCS and specified C4I systems. TCS will be capable of entering DII/COE compliant networks. Network interoperability will include but not be limited to:

- Advanced Tactical Weapons Control Station (ATWCS)
- Advanced Field Artillery Tactical Data System (AFATDS)
- Air Force Mission Support System (AFMSS)
- All Source Analysis System (ASAS)
- Automated Deep Operations Co-ordination System (ADOCS) (potential deletion of requirement pending)
- Automated Target Hand-off System (ATHS)
- Closed Circuit Television (CCTV)
- Common Operational Modeling, Planning, and Simulation System (COMPSS)
- Contingency Airborne Reconnaissance System (CARS)
- Enhanced Tactical Radar Correlator (ETRAC)
- Guardrail Common Sensor/Aerial Common Sensor (ACS)
- Integrated Processing Facility (IPF)
- Intelligence Analysis System (IAS)
- Joint Deployable Intelligence Support System (JDISS)

Joint Maritime Command Information System (JMCIS)
 Joint Service Imagery Processing System - Navy (JSIPS-N)
 Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Module/Common
 Ground Station (GSM/CGS)
 Modernized Imagery Exploitation System (MIES)
 Precision Targeting Workstation (PTW)
 Tactical Aircraft Mission Planning System (TAMPS)
 Joint Service Imagery Processing System (JSIPS) Tactical Exploitation Group (TEG)
 Theater Battle Management Core System (TBMCS)
 TROJAN Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

The TCS will export / disseminate UAV imagery products, tactical communication messages, as well as mission plans and target coordinates. TCS will also receive, process, and display tasking orders, and operational information from Service specific mission planning systems.

1.2.4 System Compliance

The TCS will be developed in compliance with the following military and commercial computing systems architecture, communications processing, and imagery architecture standards:

- a) Assistant Secretary of Defense (ASD) Command, Control, Communications, and Intelligence(C3I) Joint Technical Architecture (JTA)
- b) Airborne Reconnaissance Information Technical Architecture (ARITA)
- c) Defense Information Infrastructure (DII) Common Operating Environment (COE)
- d) Computer Open Systems Interface Processor (COSIP)
- e) Common Imagery Ground/Surface System (CIG/SS) Handbook
- f) Joint Interoperability Interfaces (JII)
- g) National Imagery Transmission Format (NITF)
- h) Variable Message Format (VMF) and Joint Message Format (JMF)

1.3 Document Overview

This SSDD provides the top level design descriptions of the TCS and allocates the system/subsystem requirements to Hardware Configuration Items (HWCI) and Computer Software Configuration Items (CSCI). Figure 1.3-1 “TCS System/Subsystem Design Document” provides a visual depiction of the document overview, purpose, and role in the TCS development process.

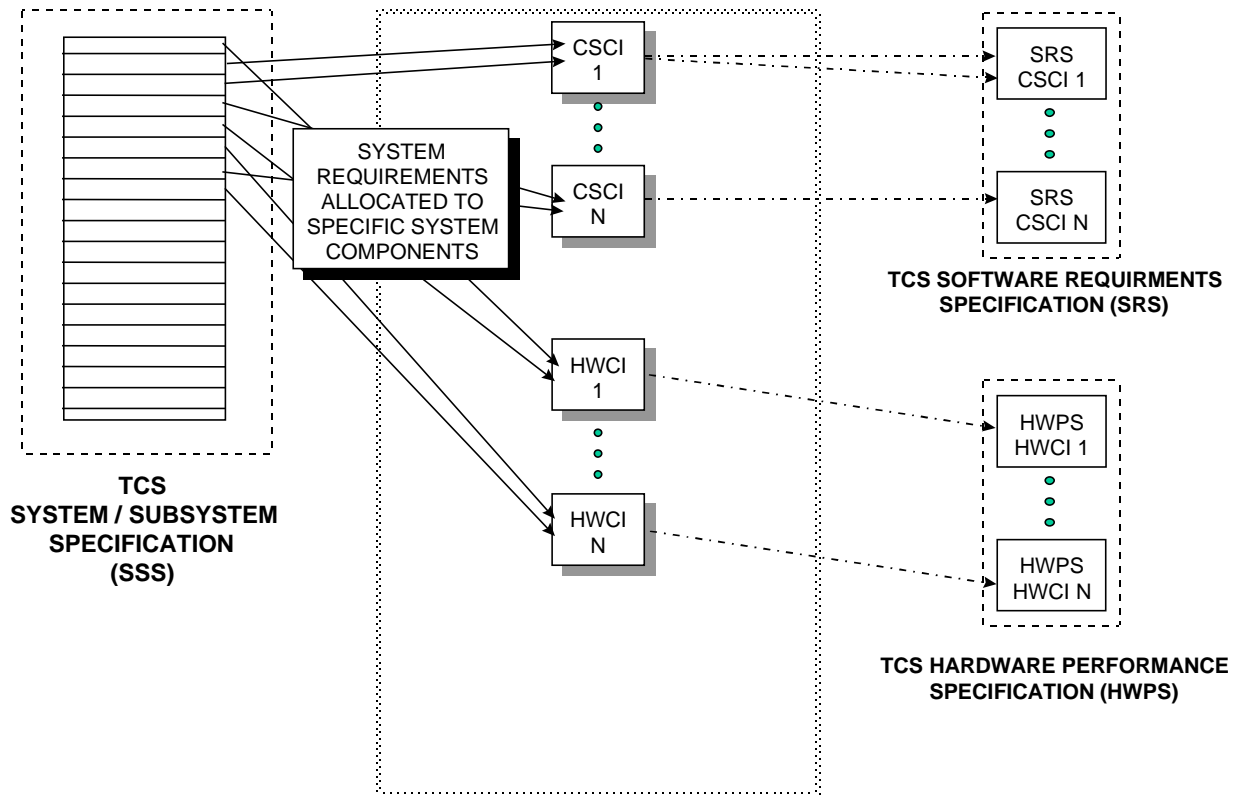


Figure 1.3-1 Visual Depiction of TCS System/Subsystem Design Document

Chapter 2 Referenced Documents

Only documents that are directly referred to in this document are included in the document lists.

Referenced documents are for guidance only.

2.1 Government Documents

2.1.1 MIL Standards

- | | | |
|----|-----------------|---|
| 1. | MIL-STD 498 | Software Development and Documentation, 5 December 1994 |
| 2. | MIL-STD-882C | System Safety Program Requirements, 19 January 1993 w/Notice 1 19 January 1996 |
| 3 | MIL-STD-1388-1A | Logistic Support Analysis, 21 January 1993 |
| 4. | MIL-STD-1388-2B | DOD Requirements for a Logistic Support Analysis, 26 November 1996 |
| 5. | MIL-STD-1472D | Human Engineering, 10 February 1994 |
| 6. | MIL-STD-2036A | Electronic Equipment Specification, General, 3 September 1993 |
| 7. | MIL-STD-2500A | Military Standard National Imagery Transmission Format (Version 2.0), 18 June 1993. |

2.1.2 DoD Documents

- | | | |
|----|---------------------------|--|
| 1. | DoD Regulation 5000.2-R | Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs |
| 1. | DoD Directive C-5200.5 | Communication Security (COMSEC), 21 April 1990 |
| 2. | DoD Directive 5200.28 (D) | Security Requirements for Automated Information Systems, 21 March 1998 |

2.2 Non-Government Documents

2.2.1 Program Documents

1. TCS 100 Operational Concept Document for the Tactical Control System
2. TCS 102 Tactical Control System System/Subsystem Specification, Version 1.0, 30 June 1997
3. TCS 116 Operational Task and Analysis Report
4. TCS 118 Operation Requirements Document for the Unmanned Aerial Vehicle Tactical Control System, Version 5.0 7 July 1997
5. TCS 200 TCS to Advanced Field Artillery Tactical Data System Interface Design Description
6. TCS 201 TCS to All source Analysis System Interface Design Description
7. TCS 203 TCS to Advanced Tactical Weapons Control System Interface Design Description
8. TCS 205 TCS to Closed Circuit Television Interface Design Description
9. TCS 206 TCS to Intelligence Analysis System Interface Design Description
10. TCS 207 TCS to Tactical Exploitation Group Interface Design Description
11. TCS 208 TCS to Automated Target Hand-off System Interface Design Description
12. TCS 209 TCS to Joint Surveillance Target Attack Radar System Interface Design Description
13. TCS 210 TCS to Joint Service Imagery Processing System-Navy Interface Design Description

- | | | |
|-----|---------|--|
| 14. | TCS 211 | TCS to Joint Service Imagery Processing System-Air Force Interface Design Description |
| 15. | TCS 212 | TCS to Joint Deployable Intelligence Support System Interface Design Description |
| 16. | TCS 213 | TCS to Trojan Spirit II Interface Design Description |
| 17. | TCS 214 | TCS to Joint Maritime Command Information System Interface Design Description |
| 18. | TCS 215 | TCS to Guardrail Common Sensor/Aerial Common Sensor Interface Design Description |
| 19. | TCS 216 | TCS to Modernized Imagery Exploitation System Interface Design Description |
| 20. | TCS 217 | TCS to Contingency Airborne Reconnaissance System Interface Design Description |
| 21. | TCS 218 | TCS to Enhanced Tactical Radar Correlator Interface Design Description |
| 22. | TCS 219 | TCS to Tactical Aircraft Mission Planning System Interface Design Description |
| 23. | TCS 220 | TCS to Air Force Mission Support Interface Design Description |
| 24. | TCS 221 | TCS to Theater Battle Management Core System Interface Design Description |
| 25. | TCS 222 | TCS to Common Operational Modeling, Planning, and Simulation System Interface Design Description |
| 26. | TCS 225 | TCS to Tactical Communication Interface Module Interface Design Description |
| 27. | TCS 229 | TCS to Tactical Control System Air Vehicle Standard Interface Design Description |
| 28. | TCS 236 | TCS to Tactical Exploration System Interface Design Description |

- | | | |
|-----|---------------|--|
| 29. | TCS 700 | TCS to Unmanned Aerial Vehicle Tactical Control System Program Management Plan, Version 4.0 6 August 1997 |
| 30. | DI-IPSC-81432 | Data Item Description System/Subsystem Design Description (SSDD) |
| 31. | DI-IPSC-81436 | Data Item Description Interface Design Description (IDD) |

2.2.2 Non-Program Documents

- | | | |
|----|----------------|---|
| 1. | CAF 003-90-I-A | Operational Requirements Document for the RQ-1A Predator Medium Altitude Endurance Unmanned Aerial Vehicle/System |
|----|----------------|---|

Chapter 3 System Wide Design Decisions

3.1 Inputs and Outputs

The TCS will have inputs from external sources, but not limited to, as shown in Figure 3.1-1.

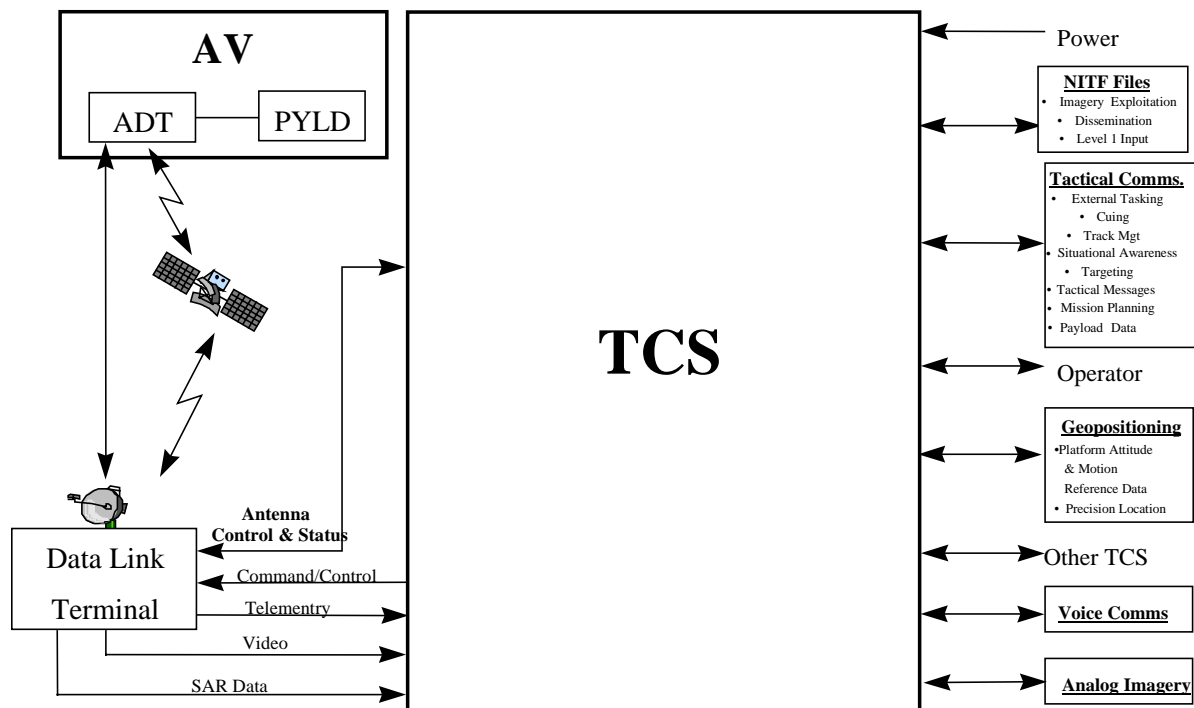


Figure 3.1-1 TCS Inputs and Outputs Flow Diagram

3.2 System Behavior

The TCS Operator(s) will be able to: Control and monitor multiple AV(s) simultaneously; control and monitor multiple payloads simultaneously; view and exploit payload data from multiple payloads simultaneously; record and retrieve payload data; format, send, and receive tactical communication messages; send and receive voice communications; send and receive analog video as well as NITF 2.0 digital imagery; plan UAV missions; monitor health and status of the TCS system

The data latency for all TCS components will not be greater than that present in the Predator ground control station or the Outrider ground control station whichever is smaller. The data latency for the Predator GCS is TBD. The data latency for the Outrider GCS is TBD.

After emplacement at the operational site, the TCS will be capable of planning, and conducting a mission within 1 hour of tasking. Required activities will include:

- 1) mission planning of a minimum 1 waypoint mission
- 2) preparing 2 AVs for flight
- 3) datalink terminal set-up
- 4) safety equipment emplaced
- 5) and a single AV launched.

The TCS will provide the capability to simultaneously view imagery as well as data from more than one payload, when applicable.

3.2.1 System Actions

System actions will be determined and specified by the Operational Task and Analysis (OTA) Report, TCS 111.

The functional areas of the system actions will consist of the following:

1. TCS System Control and Monitoring
2. Mission Planning
3. AV Systems Control and Monitoring
4. Data Acquisition and Manipulation
5. Target Coordination Development/Extraction
6. Data Import/Export and C4I

3.2.2 Response Times

There are no design decisions associated with section 3.2.2 Response Times. All such decisions are explicit in the requirements and are in sections 4.2.1.1.X

3.2.3 Error Handling

Software error handling will be left to the software design and will be realized through the use of TBD.

Hardware error handling will be realized and controlled through the use of Fault Detection/Location (F/DL).

Interface error handling will be realized and controlled by the appropriate interface protocol method

of the interface.

3.3 Safety, Security, And Privacy

There are no design decisions associated with section 3.3. All such decisions are explicit in the requirements and are in sections 4.X

3.4 Design and Construction Choices

The TCS will be functionally and physically partitioned into Hardware Configuration Items and Computer Software Configuration Items, to provide an open architecture that allows for efficient fault isolation.

The CSCI and HWCI allocations have been made in accordance with the following design considerations:

1. Be fully compatible with the TCS ORD and SSS as well as the unique requirements levied by the UAV Program, to include legacy or new developed systems
2. Be compliant with JTA, CIGS/SS and utilize DII/COE to the maximum extent practical
3. Maximize the commonality of TCS hardware and software utilized to support multiple types of AV platforms
4. Maximize the commonality of TCS hardware and software utilized to support different Payloads
5. Minimize the amount of hardware and software considered Flight Critical
6. Minimize the effect AV modifications will have to the TCS
7. Minimize the effect Payload modifications and upgrades have on the TCS
8. Minimize the effort to integrate the control of additional AV types
9. Minimize the effort to integrate the control of additional Payload types
10. Minimize the impact of C4I system upgrades and modifications on TCS
11. Minimize the coupling of Mission Planning capability with other capabilities to facilitate a separate procurement
12. Maximize commonality between TCS variant configurations (e.g., TCS-SB, TCS-LS)

During Phase 1, design and construction will be accomplished in accordance with commercial best practices unless otherwise required to meet a specific service operational environmental factor. Design and construction requirements for Phase 2 will be revised to reflect appropriate government approved sub-tier specifications controlling all aspects of electrical and electronic or mechanical designs for new or modified TCS equipment.

Data Control Modules (DCM) will allow for modulation/demodulation of the uplink/downlink

signal to/from the air vehicles. The DCMs will be developed in accordance with the AV Standard Interface IDD to insure interoperability with TCS. All software resident within a particular DCM is the responsibility of the air vehicle manufacturer and is not a TCS software configuration item.

The TCS will provide additional support equipment (Real Time Computer) required for real-time processing to include imagery processing, antenna control commands, payload commands, and launch and recovery.

Individual Datalink Terminals will be supplied by the AV manufacturers for use by TCS. Future incorporation of the Tactical Common Data Link (TCDL) will include a programmable antenna that will eliminate the need for air vehicle specific Datalink Terminals.

The TCS will incorporate a Local Area Network (LAN) architecture that include a high and low speed LAN and a high speed imagery LAN.

The TCS design will consider all safety requirements affecting design and performance except nuclear safety.

The TCS will comply with para 5.3 of MIL-STD 882C, "System Safety Program Requirements", dated 19 January 1993 w/ Notice 1 dated 19 January 1996.

The TCS design will provide protection against injury to TCS operators and maintenance personnel.

The TCS system design will use MIL-STD-2036A, Section 5.1.3.11 as a guide, with regard to personnel hazards, and MIL-STD-1472D, Section 5.13, as a guide for safety from a human engineering viewpoint.

System safety and health hazards, if any, will be identified and evaluated during Phase I of the TCS development.

Risk levels and a program to manage the probability and severity of hazards will also be developed.

The TCS will be designed to minimize the number and frequency of required preventive maintenance actions based on performance requirements and lowest life cycle costs.

The TCS will minimize the contribution to degradation of TCS equipment reliability as a consequence of performing either preventive as well as corrective maintenance.

The TCS will enable the performance of all maintenance actions with safety and comparative ease by providing adequate access to all equipment components and minimizing the requirements for special tools and test equipment.

To the extent possible, the TCS design will minimize the requirement for specially trained maintenance personnel.

In addition to FD/L, TCS design will improve system availability by the effective selection and incorporation of Built In Test Equipment (BITE).

The TCS will be designed in a manner that will allow for removal and replacement of replaceable units without soldering and unsoldering.

The TCS equipment will achieve an availability (A_o), as defined by the below equation

$$A_o = (OT + ST) / (OT + ST + TPM + TCM + TALDT)$$

where:

| | |
|-------|--|
| OT | denotes Operate Time |
| ST | denotes Standby Time |
| TPM | denotes Total Preventative Maintenance |
| TCM | denotes Total Corrective Maintenance |
| TALDT | denotes Total Administrative and Logistic Downtime |

The threshold A_o for the TCS will be greater than or equal to 90%, with an objective A_o of 95%.

The TPM on a non interference basis will not exceed 1 hour per day. Preventative Maintenance (PM) on an interference basis will be acceptable, but shall not exceed 1 hour per week.

The TCS will achieve a threshold system reliability (Mean Time Between Failures MTBF) equal to or greater than 2000 hours, with an objective system reliability of 3000 hours.

The TCS maintainability will be considered in every phase of the design and development process. The TCS threshold maintainability (Mean Time To Repair (MTTR)) will be equal to or less than 1.9 hours, with an objective maintainability that will be equal to or less than 1 hour.

The total, fully useable, addressable, physically present program instruction memory and data storage memory for each processor will have at least 50% unused memory during the Normal Operations Mode over any 10 second period.

The processing speed of each processor will be such that at least 50% of the throughput of each processor remains unused over all 10 second periods and at least 20% of the throughput of each processor remains unused over one second periods regardless of the system function performed.

The Input/Output (I/O) channel reserve capability for each processor will have at least a 50% reserve, addressable and useable, I/O channel capacity over any 10 second period.

All hardware components (developed or selected to be used in the TCS design) , to the extent possible, will support the concepts of modularity, scalability, and future growth. Actual physical characteristics of the various hardware components will vary dependent on implementation details and will be determined during Phase 1 Program Definition and Risk Reduction of TCS.

The hardware components used in the TCS design will provide the flexibility to host various software packages (developed or selected) that are used by the TCS. The software components used in the TCS design, to the extent possible, will be host hardware independent and portable to all Non-Real Time Computer HWCIs.

The selection of TCS HWCIs to include processors, interface cards for communication interfaces, disk drives, video, networking equipment, and all other hardware for use in the TCS will be made according to standards for production of an open architecture.

Testability will be considered in the design and development of the TCS components.

Control over TCS components (HWCIs and CSCIs) will be provided for detecting and isolating

internal faults.

Test points and data paths will be defined to support efficient fault isolation.

During Phase 1, control techniques to minimize electromagnetic interference (EMI), emanation, and susceptibility will be used in the design of TCS equipment. This control will be inherent in the design of the TCS and the electrical and electronic equipment components and assemblies thereof.

There will be neither unacceptable response nor malfunction of any TCS and associated equipment due to Electromagnetic Interference produced by any as well as all of the TCS and equipment associated with the TCS.

The TCS will be compatible with the external electromagnetic environment that is typical of the service specific environment in the TCS will be operated. The specific electromagnetic environment values will be determined during Phase I of the TCS development.

The TCS design will ensure that personnel, fuel, and ordinance are not exposed to electromagnetic radiation as a result of operating the TCS. The specific radiation hazard (RADHAZ) and Hazards of Electromagnetic Radiation to Ordnance (HERO) values will be determined during Phase I of the TCS development.

The TCS will be designed to protect its communication and data links against enemy Electronic Warfare (EW) threats, physical anti-radiation weaponry and physical destruction.

The TCS will have ergonomically designed operator controls and displays for the 5th percentile female to 95th percentile male operator.

See Appendices A and B of this document for configuration specific design and construction choices made of the TCS-Land Shelter (LS) and TCS-Sea Based (SB) configurations.

3.5 Logistics Related Requirements

The Subsystems will be supported by the services' standard logistic system. Logistic support requirements will be determined by the Logistic Support Analysis (LSA) process which will influence system development and support. LSA will be performed on all equipment on which no previous analyses have been made. The logistics analysis process will be accomplished IAW MIL-STD-1388-1 tailored to fit program requirements. The resulting data, when applicable, will be recorded in the Logistics Support Analysis Record (LSAR) IAW MIL-STD-1388-2. The LSA program will be the single analytical effort to evaluate design alternatives, to determine the most cost efficient methods of providing logistics support, and to acquire data required to provide integrated logistics support. Operator, unit maintainer, and intermediate maintenance tasks identified in the LSA/LSAR process will be addressed in the training documentation. Logistics specifications are further defined in the Integrated Logistics Support Design Specification (ILSDS).

Support for the TCS will be in accordance with the Integrated Logistical Support Plan (ILSP) and the maintenance concepts and policies of the individual Services.

All TCS Operator Manuals and Technical Manuals will be verified and validated prior to initial operational test.

TCS transport and storage containers will be reusable and enable the operators to set-up equipment within the established timelines in their ORDs.

The TCS will adhere to DOD regulations and policy governing military standards for logistics, Petroleum, Oil and Lubricants (POL), tools, Test, Measurement, and Diagnostic Equipment (TMDE), tools, and other support items.

Standard tools, TMDE, repair parts, and lubricants will be used to maintain the TCS. Exceptions shall be considered on a case by case basis.

Each Service will support the TCS as part of the UAV system which is organic to them.

The TCS will be maintained in accordance with the UAV ORD for that Service and the Level Of Repair Analysis (LORA) for the hardware chosen.

A TCS support and fielding package will be developed and available for operational testing.

The TCS will be maintained in accordance with Services' approved UAV maintenance concepts and procedures.

To the maximum extent possible, general purpose test equipment (GPTE) and common tools resident in each service will be used to perform all corrective and preventative maintenance at all authorized levels of maintenance.

Tools and test equipment required to maintain the TCS but not resident in each service inventory will be identified as special tools and special purpose test equipment (SPTE), respectively, and kept to a minimum.

The environmental support required by the TCS will be the same as that required for the respective UAV System.

Basing for the system will follow the plan for UAV units and service command echelon requirements as delineated in the ORD.

3.6 TCS Design Documents

System requirement and interface documentation will be developed as part of the TCS program and will follow MIL-STD-498 format. Technical and Operator Manuals will follow the Technical Manual Contract Requirements (TMCR).

The documentation developed will contain sufficient level of detail to identify the functional, operational and design requirements of the TCS.

The documentation will contain sufficient technical detail to define the hardware and software design implemented to satisfy the system requirements.

Chapter 4 System Architectural Design

The TCS will operate in the field IAW the TCS Concept of Operations (CONOPS) document but the system architecture design is IAW the TCS SSS. The TCS technical architecture will follow and comply with the Joint Technical Architecture, CIG/SS, and the DII/COE. The physical system architecture that will be utilized and implemented is depicted in the block diagram Figure 4.0-1.

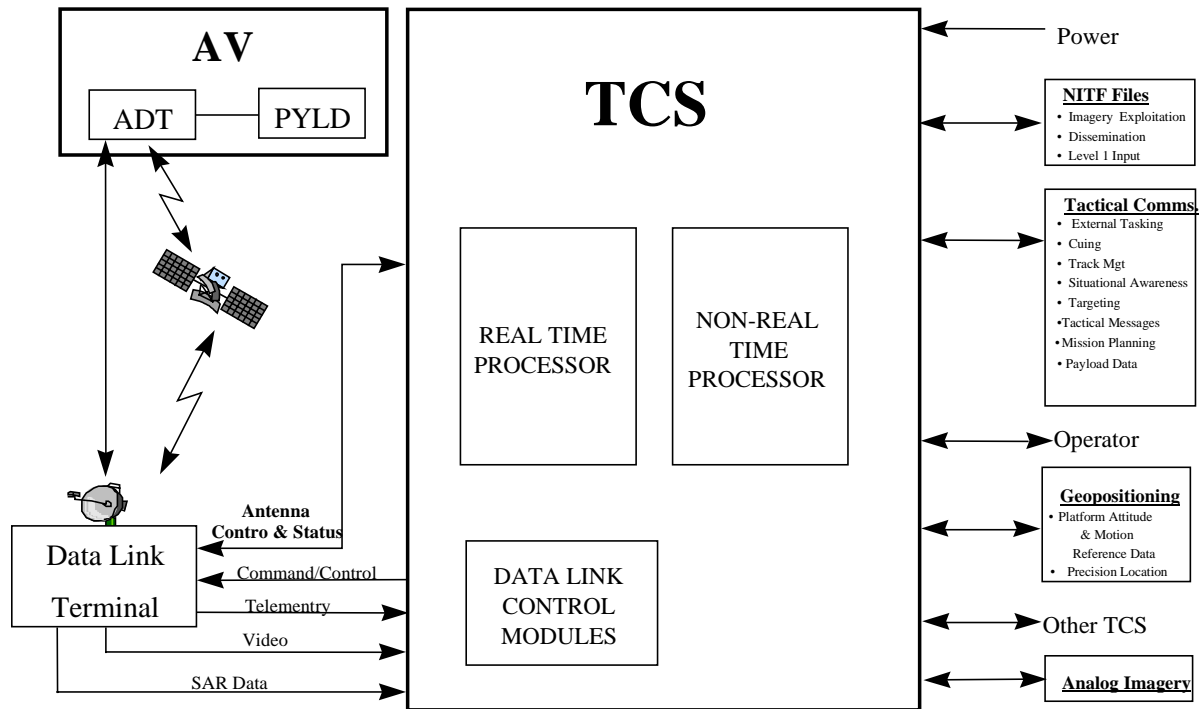


Figure 4.0-1 TCS System Architecture

The TCS shall transmit command and control information to the Air Vehicle (AV) via the uplink (SSS110) [SSDD001], and receive AV telemetry and payload information via downlink from the AV (SSS111) [SSDD002].

The TCS shall be capable of interfacing with the specified datalink terminal and issuing datalink terminal commands required to establish, control, and maintain the data link with a selected AV. (SSS159)[SSDD003]

4.1 System Components

The TCS shall be partitioned into the following CSCIs: DII/COE, Common UAV Control, TCS Data Server (DS), TCS Mission Planner, Real Time Processes (RTP), Synthetic Aperture Radar (SAR), FD/L & Diagnostics, AV Diagnostics, Datalink Control Module, and C4I Interfaces. (SSS422) [SSDD004]

The TCS system components will be defined and consist of the HWCIs and CSCIs as identified in this document. Components do not equate to subsystems of TCS.

The TCS hardware will consist of a Non-Real Time (NRT) Computer and other specific hardware (e.g. video matrix, amplifiers, converters, VCR, monitors, etc.) necessary to support operations.

Figure 4.1-1 provides a detailed block diagram of the overall system physical hardware architecture.

Figure 4.1-2 provides a notional depiction of the information flow paths between the TCS components.

For each Outrider system, the TCS components shall provide full independent computer redundancy for all safety of flight items. (SSS380) [SSDD005]

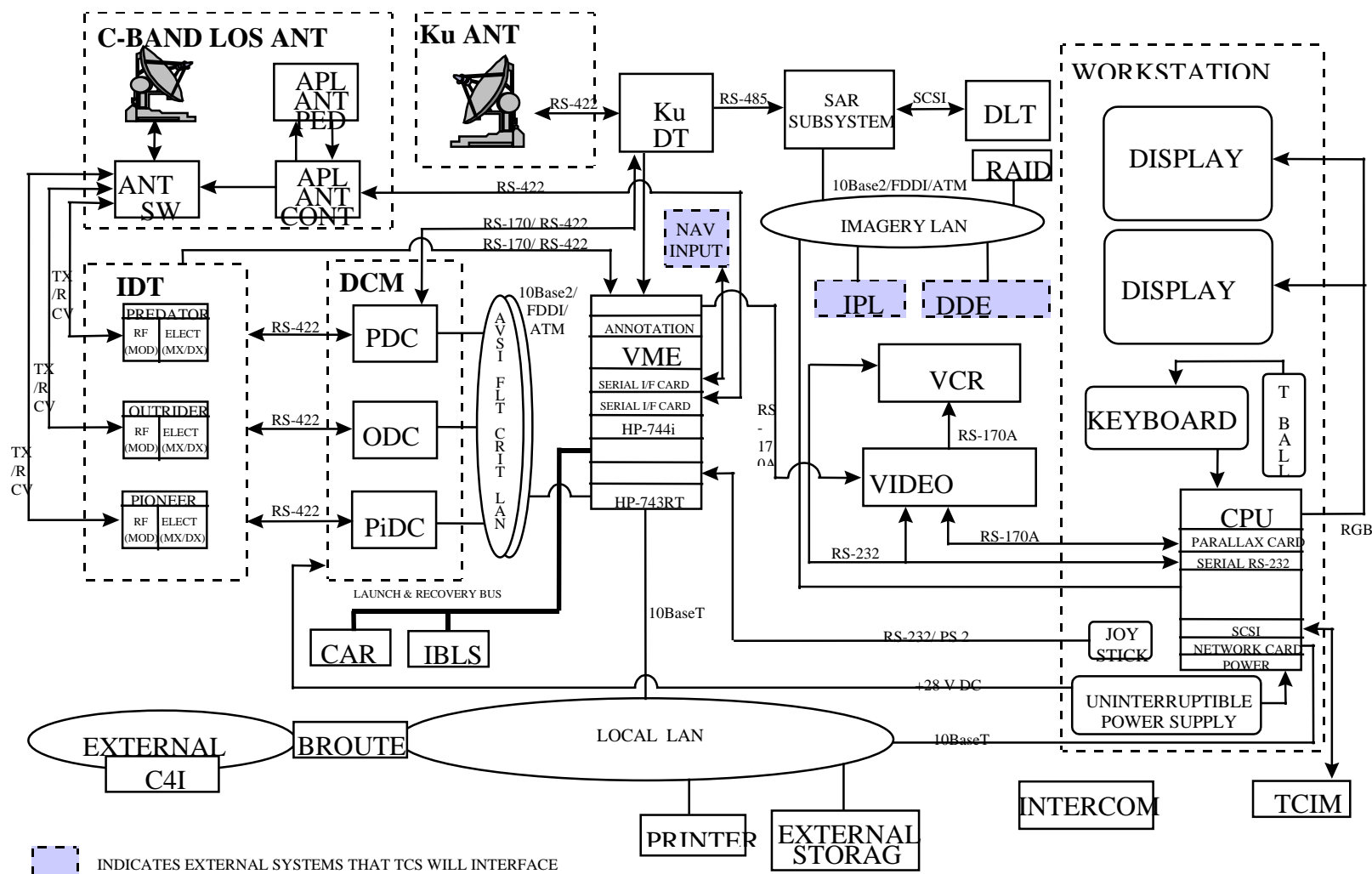


Figure 4.1-1 TCS Physical Hardware Architecture

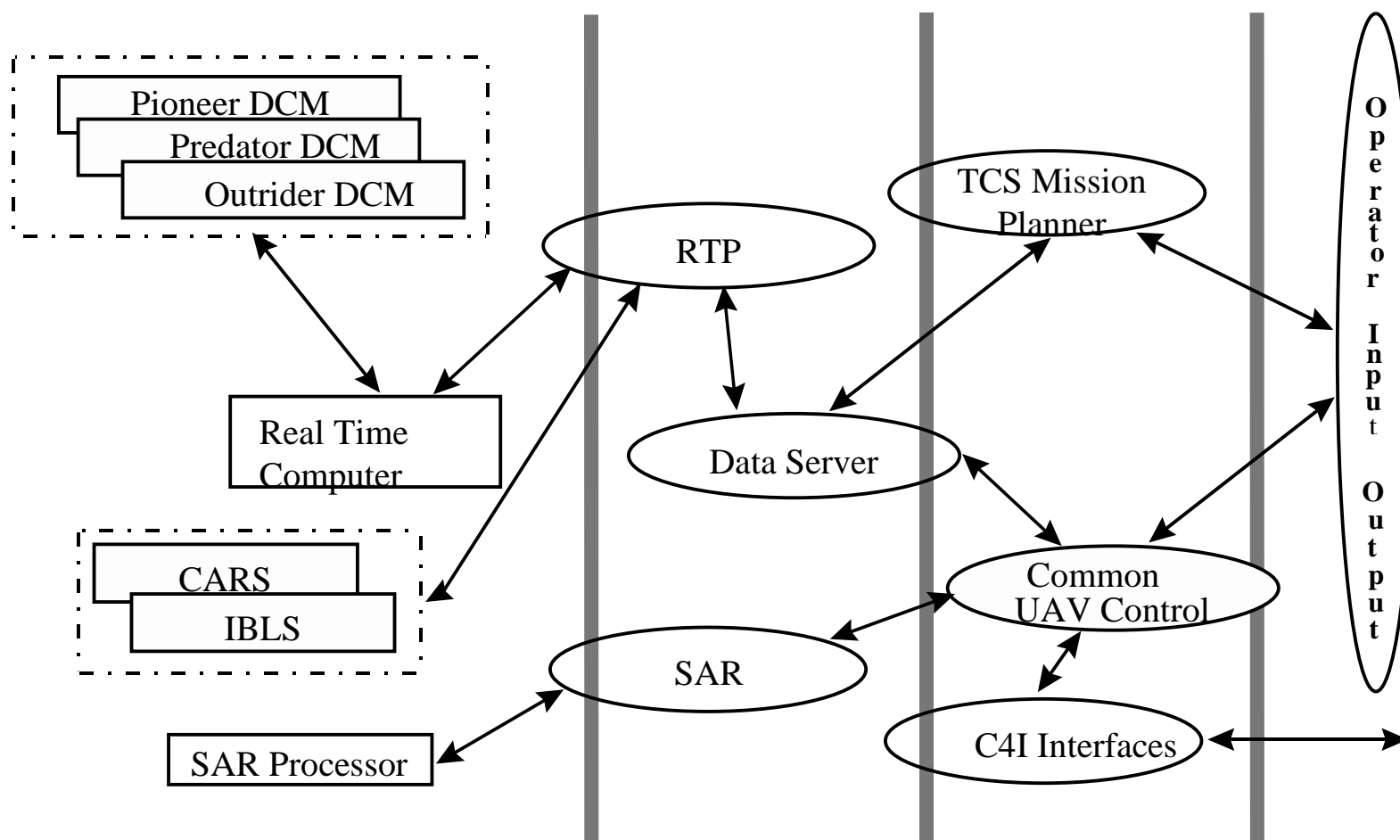


Figure 4.1-2 TCS Imagery and Information Flow Diagram

4.1.1 TCS Hardware Configuration Items (HWCI)

The TCS shall contain a configuration specific Uninterruptible Power Supply HWCI. (SSS004) [SSDD006] The TCS may contain a configuration specific NRT Computer HWCI.

The TCS support equipment shall include the following: C4I Support Equipment HWCI, Communication Equipment HWCI, Intercom Equipment HWCI, External Storage HWCI, Printer HWCI, Datalink Terminal HWCI, UCARS HWCI, Integrity Beacon Landing System (IBLS) HWCI, and Manual Controls HWCI. (SSS004) [SSDD007]

In the selection of HWCI to satisfy the requirements herein, Non-Developmental Items (NDI) (off-the-shelf equipment previously approved for service use) shall be chosen to the maximum practicable extent. (SSS426) [SSDD0008] If NDI that provides the desired functions can not be identified, then Commercial-Off-The-Shelf (COTS) hardware shall be used. (SSS426) [SSDD009]

TCS material factors shall be governed by the NDI, GFE, and COTS specifications developed by the equipment manufacturers, where applicable. (SSS431) [SSDD996]

The HWCI of the TCS shall be capable of being scaled as well as being modular to meet the varying needs of the Services. (SSS374) [SSDD010]

The TCS HWCI shall be mounted as well as ruggedized to withstand inter and intra theater movement. (SSS373) [SSDD011]

The TCS HWCI shall allow the air vehicle and payload operators to perform mission control, mission monitoring, and mission updates and modifications while wearing cold weather clothing and in a Mission Oriented Protective Posture (MOPP). (SSS444) [SSDD012]

Hardware error handling shall be realized and controlled through the use of Fault Detection/Location (FD/L). (SSS036) [SSDD013]

The selection of TCS HWCI to include processors, interface cards for communication interfaces, disk drives, video, networking equipment, and all other hardware for use in the TCS shall be made according to standards for production of an open architecture. (SSS419) [SSDD014]

All hardware components (developed or selected to be used in the TCS design), to the extent possible, shall support the concepts of modularity, scalability, and future growth. (SSS440) [SSDD015] Actual physical characteristics of the various hardware components will vary dependent on implementation details and will be determined during Phase 1 Program Definition and Risk Reduction of TCS.

The hardware components used in the TCS design shall provide the flexibility to host various software packages (developed or selected) that are used by the TCS. (SSS418) [SSDD016] The software components used in the TCS design, to the extent possible, will be host hardware independent and portable to all NRT Computer HWCI.

4.1.2 NRT Computer Software Configuration Items (CSCI)

The TCS shall utilize operating systems and programming languages that are DII/COE compliant and support an open architecture environment. (SSS420) [SSDD017]

The TCS software shall be developed using UNIX as the operating system. (SSS420) [SSDD018]

For the windowing environment TCS shall use X-windows (SSS447) [SSDD019], and Graphical User Interface (GUI) application development shall use Motif. (SSS447) [SSDD020]

The TCS software development language shall be primarily Ada95, but specific application functionality may be developed using ANSI C. (SSS420) [SSDD021]

The use of machine dependent assembly languages shall be minimized to only those interfaces where direct machine control is required. (SSS420) [SSDD022]

The TCS components shall conform with the National Institute for Standard Technology (NIST) Federal Information Processing Standard (FIPS) Publication 151-2(POSIX.1). (SSS381) [SSDD023]

Each of the TCS CSCIs will conform to the following basic requirements:

1. Design Standards
2. Security
3. Reliability
4. Training
5. Warnings
6. HCI
7. System Status

4.1.2.1 Design Standards

The TCS CSCIs shall be based on Defense Information Infrastructure/ Common Operating Environment as per Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) Joint Technical Architecture. (SSS393) [SSDD024]

The TCS CSCIs shall comply with the Assistant Secretary of Defense (C3I) Joint Technical Architecture (JTA). This includes, as a minimum, the language, the computer, the database, architecture, and interoperability. (SSS394) [SSDD025]

The TCS CSCIs shall provide an open software architecture to be capable of supporting additional CSCIs, CSCs, and CSUs for future AVs, future payloads, and payload capabilities (e.g. auto-search and automatic target tracking), and future Tactical UAVs. (SSS395) [SSDD026]

The TCS CSCIs shall be generically written to provide level one through level five interaction for both Outrider and Predator UAVs and establish the architecture for future Tactical UAVs. (SSS396) [SSDD027]

All TCS CSCIs shall be capable of being hosted on service specific computer operating systems such as TAC-X (Navy), CHS-II/SPARC 20 (Army, Marines), and SGI/DEC (Air Force) as specified in the Non-Real Time Computer HWCIs. (SSS398) [SSDD028]

The TCS CSCIs shall provide a windows based graphic operator interface. (SSS399) [SSDD029]

The TCS CSCIs shall be non proprietary and have unlimited data rights. (SSS400) [SSDD030]

The TCS CSCIs shall be re-programmable without hardware disassembly. (SSS401) [SSDD031]

TCS CSCIs flexibility and expandability shall be provided through use of the DII/COE and through use of standardized software development practices. (SSS417) [SSDD032]

The TCS CSCIs shall provide the common software architecture for TCS interaction with Predator, Outrider, and future Tactical UAVs. (SSS425) [SSDD033]

Newly designed TCS CSCIs shall be developed in accordance with a tailored MIL-STD-498. (SSS437) [SSDD034]

Software written for other systems shall be used in TCS CSCIs where it is determined that the existing software is suitable and provides the required functionality. (SSS438) [SSDD035]

A modular architecture shall be used by the TCS CSCIs in order to support future interoperability with multiple types of UAVs and payloads while maintaining consistent displays and user interfaces. (SSS439) [SSDD036] Software components satisfying common planning and control functions shall allow for Air Vehicle specific components to be integrated in the future.

4.1.2.2 Security

The TCS is an Automated Information System (AIS). As such, as per DoD Regulation 5000.2-R, dated March 15, 1996, all TCS CSCIs shall satisfy all software security requirements in accordance with DoD Directive 5200.28(D), "Security Requirements for Automated Information Systems" dated March 21, 1988. (SSS361)[SSDD037]

The TCS CSCIs shall be accredited by the Designated Approving Authority prior to processing classified or sensitive unclassified data. (SSS362)[SSDD038]

Using risk assessment procedures defined in DoD 5200.28(D), a risk index and the minimum security requirements for access to the TCS CSCIs shall be determined. (SSS363)[SSDD039] The inputs to this procedure is the clearance or authorization of the TCS users and the sensitivities of the data that the TCS processes, stores or transfers. These requirements pertain to the NRT Computer hardware and software

The TCS CSCIs data sensitivities shall be determined by the data sensitivities of the systems with which they interface with, including the air vehicles, payloads, and C4I systems. (SSS364)[SSDD040] The outputs of this procedure are the TCS mode of operation and a digraph that the TCS must minimally satisfy. The digraph (e.g., B1, C2) names the class of security requirements, specified in DoD 5200.28-STD, "Trusted Computer Security Evaluation Criteria (TCSEC)", that the TCS CSCIs have to satisfy.

All hardware, software, documentation, and sensitive information used in conjunction with TCS CSCIs shall be physically protected, minimally at the level determined by the risk index computed in relationship to requirements SSS363 and SSS364, to prevent intentional or unintentional disclosure, destruction, or modification. (SSS367)[SSDD041]

The TCS CSCIs shall be physically secured to the same degree as the systems with which they interface. (SSS368)[SSDD042]

All TCS programmers, users, operators, maintainers and other personnel having access to the TCS CSCIs shall be cleared to the highest sensitivity of the data that the TCS processes, stores or transfers. (SSS369)[SSDD043]

Additional local site procedures, for the TCS CSCIs, shall be developed to prevent the intentional or unintentional disclosure of sensitive information to unauthorized individuals. (SSS370)[SSDD044]
These procedures will include the use of passwords for access to the TCS CSCIs.

4.1.2.3 Reliability

Testability shall be considered in the design and development of the TCS CSCIs. (SSS421)[SSDD045]

The TCS CSCIs shall provide the capacity for detection and isolation of internal faults. (SSS423)[SSDD046]

The TCS CSCIs shall define Test points and data paths to support the testing strategy. (SSS424)[SSDD047]

4.1.2.4 Training

Additional TCSs shall be required to support the Joint DoD UAV Training Center. (SSS492)[SSDD048]

All CSCIs via the NRT Computer shall provide a high resolution, computer generated, graphics user interface that enables the UAV operator that is trained on one system to control different types of UAVs or UAV payloads with minimal additional training. (SSS404)[SSDD049]

4.1.2.5 Warnings

The TCS CSCIs shall provide the operator a caution and warning diagnostic when the TCS system has identified a malfunction. (SSS445) [SSDD050]

When performing a given task during mission execution, the TCS CSCIs shall provide the operator with appropriate warning messages from other concurrently-executing subsystem tasks. (SSS448)[SSDD051]

The TCS CSCIs shall provide warning messages that are color coded and flashed based on mission criticality. The color codes and flash frequencies will follow MIL-STD 1472 guidelines. (SSS449)[SSDD052]

The TCS CSCIs shall require the operator to enter an acknowledgment prior to disabling the display of critical warning flags for any AV, Payload, ADT, GDT, and TCS faults. (SSS450) [SSDD053]

The TCS CSCIs shall provide visual alerts to the operator in the form of a displayed message box that has a display priority greater than other existing windows to ensure that it is viewable immediately by the operator. (SSS452) [SSDD054] The position of the displayed message window shall be easily adjustable by the operator to ensure that important mission data is not obscured. (SSS453) [SSDD055]

In addition to displayed alert messages, the TCS CSCIs shall provide auditory alerts to include tones to the TCS operator. (SSS454) [SSDD056] The volume of these auditory tones shall be adjustable by the operator via keyboard and trackball input to at least 20dB above the speech interference level at the operator's ear. (SSS455) [SSDD057] The TCS CSCIs shall archive warning messages and HCI actions for later review. (SSS456) [SSDD058]

All operator inputs shall be error checked by the respective TCS CSCI against reasonable minimum and maximum values such that any erroneous operator entry will not cause current processing to terminate. (SSS457)[SSDD059] Upon detecting an operator input error, the TCS CSCIs shall prompt the operator for a valid input. (SSS458) [SSDD060]

For AV safety or mission-critical Warnings, the TCS CSCIs shall provide a default selection as well as an override option, along with a selection of adaptive responses, and the minimum information necessary to assist the operator in responding quickly and adaptively to the emergency. (SSS487) [SSDD061]

4.1.2.6 HCI

The TCS CSCIs shall have, at a minimum, the functionality to display the following four display windows: (SSS405) [SSDD062]

- i. Display to provide aircraft position, TCS position, flight path, and waypoint graphics in the foreground which are positioned in relation to a map displayed in the background
- ii. Display to provide aircraft flight data or payload data in the foreground, and downlinked video in the background
- iii. Display to provide graphic presentations of downlinked telemetry data
- iv. Display to present the interface menus for NRT Computer software

The TCS CSCI controls shall allow the air vehicle and payload operators to perform mission control, mission monitoring, and mission updates and modifications while wearing cold weather clothing and in a Mission Oriented Protective Posture. (SSS444) [SSDD063]

The TCS CSCIs shall be menu driven and have displays in a X-windows motif. (SSS447) [SSDD064]

The TCS CSCIs shall error check all operator inputs such that any erroneous operator entry will not cause current processing to terminate. (SSS457) [SSDD065] The HCI shall prompt the operator for a valid input. (SSS458) [SSDD066]

The TCS CSCIs, and their associated HCIs, shall not generate display jitter and flicker detectable by the operator. (SSS459)[SSDD067]

The TCS CSCIs shall provide HCI that supports operation of the system in the Start-Up, Operations, and Shutdown States. (SSS461) [SSDD068]

The TCS CSCIs shall provide HCI that supports operation of the system in the Normal Operations, Training Operations, and Maintenance Operations Modes. (SSS461) [SSDD069]

The TCS CSCIs shall provide HCI that supports operation of the system for the following functions of the Normal and Training Operations Modes: Mission Planning, Mission Control and Monitoring, Payload Processing, Targeting, and C4I Interfacing. (SSS461) [SSDD070]

The TCS CSCIs shall provide HCI that supports operation of the system for the following functions of the Maintenance Operations Mode: AV Maintenance, Payload Maintenance, Datalink Terminal Maintenance, NRT Computer and Peripheral Maintenance, Extensive FD/L, Software Upgrade, and Software Debug. (SSS461) [SSDD071]

The Human Computer Interfaces (HCIs), associated with each of the TCS CSCIs, shall be designed and implemented in accordance with the HCI Design Approach for the UAV TCS document. (SSS462) [SSDD072]

The HCI, associated with each of the TCS CSCIs, shall provide redundancy in all operations, so that the loss of any one HCI input device does not prohibit operation of any TCS function. (SSS463) [SSDD073]

The TCS CSCs shall provide the functionality to display all HCI elements on any available monitor on the NRT Computer. (SSS464) [SSDD074]

The TCS CSCIs shall be capable of displaying a window within a window format to include, as a minimum, displaying a video window overlaid on a map screen as well as a map screen overlaid on a video screen. (SSS465) [SSDD075]

The TCS CSCIs shall provide full complementary control operations from the keyset as well as the X/Y control devices (e.g., trackball, mouse, joystick). (SSS466) [SSDD076]

The TCS CSCIs shall provide access to the DII Style Manager to allow the modification of pointing device characteristics. (SSS467) [SSDD077] These pointing device characteristics will include, as a minimum, button configuration, double-click speed, icon selection, speed control, and trail selection.

The TCS CSCIs shall provide a capability for porting an off-the-shelf, complex control joystick with at least two X/Y control devices, multiple toggle and multi-position switches as part of the TCS hardware suite. (SSS468)[SSDD078]

The TCS CSCIs shall use graphical representations to convey information, such as system status, C4I links, and AV-GDT links. (SSS469) [SSDD079]

The TCS CSCIs shall provide for multi-level information display tailoring by the operator. (SSS470) [SSDD080]

The TCS CSCIs shall provide automated TCS system information, control options, and logical & simple operator guidance and support for immediate and adaptive responding to crisis situations. (SSS471) [SSDD081]

The TCS CSCIs shall provide maximum automated system software support to system status monitoring and alerting of the TCS operator when a preset system parameter goes under as well as over a set threshold. (SSS472) [SSDD082]

The TCS CSCIs shall provide the necessary processing, display, and control capabilities to ensure dynamic situational awareness input to the TCS operator. (SSS473) [SSDD083]

The TCS CSCIs shall minimize alphanumeric data display in favor of graphic, pictorial information display. (SSS474) [SSDD084]

The TCS CSCIs shall provide unambiguous AV and payload control and status feedback indicators to ensure safe, efficient operations of two AVs and their payloads by a single TCS station. (SSS475) [SSDD085]

The TCS CSCIs shall provide for a specific icon shape on a constant contrast background, as well as other visual information coding mechanisms, to cue the TCS operator regarding which UAVs are under his or her primary control. (SSS476) [SSDD086]

The TCS CSCIs shall provide the capability to select and amplify an object and point on a map as well as payload screen. (SSS477) [SSDD087]

The TCS CSCIs shall provide coarse and fine payload control capabilities directly on the payload screen. (SSS478) [SSDD088]

The TCS CSCIs shall display the SAR imaging swath on the map display. (SSS479) [SSDD089]
The TCS HCI shall provide the on-screen capability to select and efficiently move as well as reorient a previously defined SAR imaging swath. (SSS480) [SSDD090]

The TCS CSCIs shall provide the capability to lock onto and hold a coordinate point on the payload imagery window. (SSS481) [SSDD091]

The TCS CSCIs shall provide for a rapid means to cancel aural warnings. (SSS484) [SSDD092]

The TCS CSCIs shall provide for separation, grouping, and visual coding of multiple categories of alerts, to include Warnings, Cautions, and Advisories. (SSS485) [SSDD093]

The TCS CSCIs shall provide for visual Warnings, Cautions, and Advisories to be displayed at or near the center of the field of view, i.e., within a 30° cone, of all monitors in a TCS system. (SSS486) [SSDD094]

The TCS CSCIs shall provide for on-screen information to include, as a minimum, overlays, headers, cursors, alphanumeric annotation, waypoints, crosshairs, designed to be visible against the complete spectrum of map and payload video backgrounds. (SSS488) [SSDD095]

The TCS CSCIs shall provide continuously-available, on-screen control functions for time and mission-critical operations, to include as a minimum print, freeze, declassification, mark VCR, declutter, cease RF transmission. (SSS489) [SSDD096]

The TCS CSCIs shall provide for the capability to automatically overlay designated target locations from the payload screen onto the map screen. (SSS490) [SSDD097]

4.1.2.7 System Status

The TCS CSCIs shall prevent Operations State modes from existing concurrently. (SSS033)[SSDD098]

The TCS CSCIs shall provide for FD/L to the Line Replaceable Unit (LRU) level to indicate the readiness status of TCS. (SSS249) [SSDD099]

4.2 Subsystems

The TCS will consist of the following subsystems: AV Communications, Launch and Recovery, Real Time, Payload, Operator Station, Communications, and Power Distribution. Figure 4.2-1 shows the various subsystems with the respective HWCIs and CSCIs.

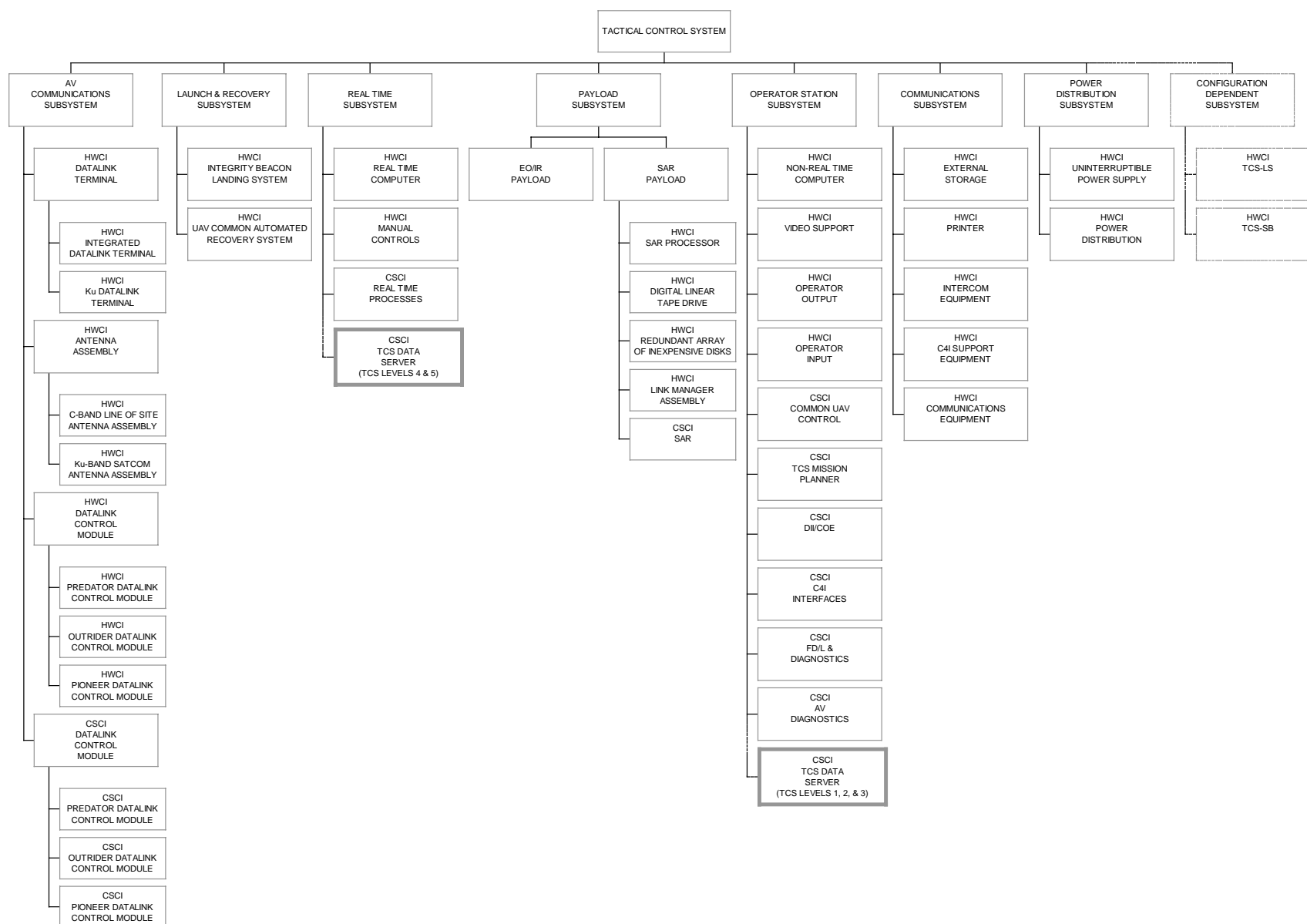


Figure 4.2-1 TCS System/Subsystem Hierarchy Diagram

4.2.1 AV Communications Subsystem

The AV Communications Subsystem consists of the HWCIs and CSCIs necessary for communication between TCS and the UAV.

4.2.1.1 AV Communications Subsystem Hardware Configuration Items

The AV Communications Subsystem will consist of the following HWCIs: Datalink Terminal, Datalink Control Module, and Antenna Assembly.

4.2.1.1.1 Datalink Terminal HWCIs

The purpose of the Datalink Terminal HWCIs is to provide the data interface between the TCS and AV(s). These HWCIs will support communication with the AV Air Data Terminal (ADT) in order to accomplish launch and recovery, flight of the AV, and control of the AV payload(s). The Datalink Terminal HWCIs will consist of the Integrated Datalink Terminal and SATCOM Datalink Terminal. The Integrated Datalink Terminal will provide a C-Band (4.5 to 6.85 GHz) LOS communication capability with the Predator, Outrider, and Pioneer air vehicles. The Ku Datalink Terminal will provide Ku-Band (12.5 to 18.5 GHz) capability with Ku-Band capable air vehicles.

TCS Datalink Terminal HWCIs shall support a concurrent uplink and downlink capability. (SSS325)[SSDD100] Figure 4.2.1.1.1-1 shows the frequency ranges for specific AVs.

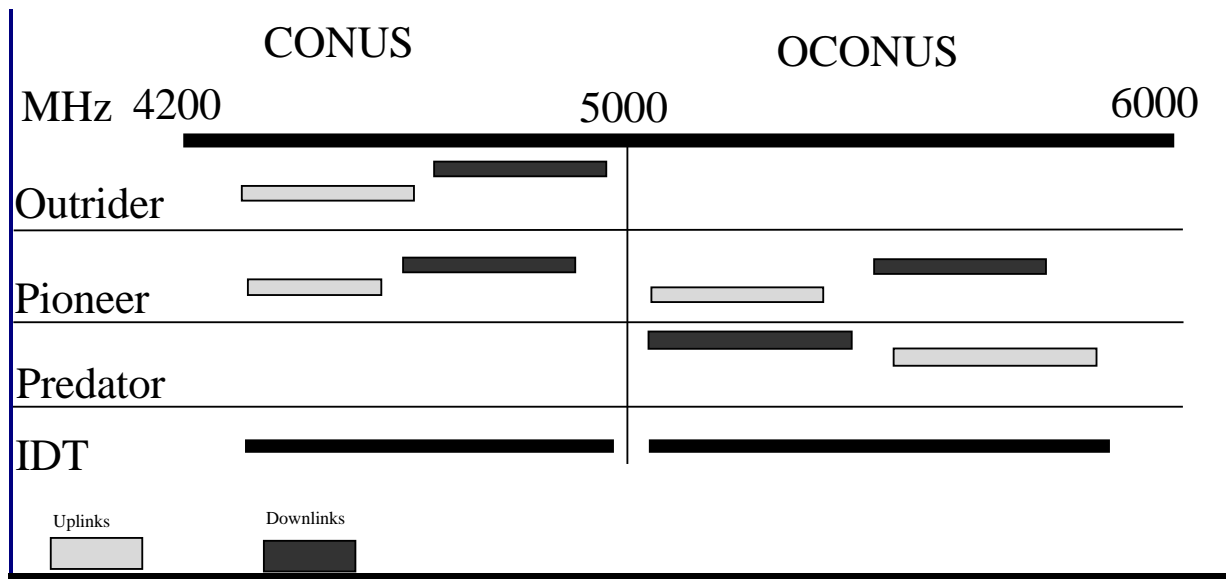


Figure 4.2.1.1.1-1 TCS C-Band Frequency Ranges

The TCS Datalink Terminal HWCIs shall support the data rate characteristics of the specific AV, datalink, and payload to ensure interoperability with all TUAV and HAE mission configurations. (SSS379) [SSDD101] Table 4.2.1.1.1-1 shows the data rate characteristics currently supported by the identified AVs and their associated datalinks.

Table 4.2.1.1.1-1 TCS Data Rate Characteristics

| UAV | Function | Uplink (MHz) | Modulation | Downlink (MHz) | SubCarrier | Modulation |
|-----------------|----------|-----------------|--------------|-------------------|------------|--------------|
| <i>Outrider</i> | LOS | 4400-4625 | FSK | 4775-5000 | 7.5 MHz | NTSC/FSK |
| | | | | | | |
| <i>Pioneer</i> | LOS | 420-450 | FSK | None | None | None |
| | | 4450-4570 | BPSK | 4750-4950 | 7.5 MHz | NTSC/FM |
| | | 5252-5450 | BPSK | 5650-5850 | 7.5 MHz | NTSC/FM |
| | | | | | | |
| <i>Predator</i> | LOS | 5625-5850 | FSK | 5250-5475 | 6.8 MHz | NTSC/FM |
| | SATCOM | 11450-11950 | OQPSK | 14000-14500 | None | OQPSK |
| | | 251.95-269.95 | BPSK & OQPSK | 292.95-310.95 | None | BPSK & OQPSK |
| | | | | | | |

The TCS Datalink Terminal HWCIs shall have sufficient throughput to support the processing requirements of the selected datalink. (SSS382) [SSDD102]

The TCS shall incorporate antenna pedestal 3-axis stabilization to compensate for platform (e.g. ship or HMMWV) motion, if applicable. (SSS557) [SSDD103]

The Datalink Terminal HWCIs shall be initialized upon operator selection of a specific AV for use in ground based closed loop command and control functions. (SSS109)[SSDD104]

The Datalink Terminal HWCIs shall provide for air vehicle flight control for line of sight via uplink command for a minimum of two air vehicles of the same type using sequential communication techniques. (SSS125)[SSDD105] Sequential communication means alternatively communicating with one air vehicle and then the other. Current air vehicle design does not permit concurrent communications with two air vehicles at the same time.

Data terminal control shall include, but is not limited to transmitter and receiver control. (SSS160)[SSDD106]

4.2.1.1.1.1 Integrated Datalink Terminal HWCI

The purpose of the Integrated Datalink Terminal (IDT) HWCI is to provide an interface between the DCM HWCI and the LOS Antenna Assembly HWCI.

Figure 4.2.1.1.1-1 shows an interconnectivity diagram of the IDT HWCI in addition to the LOS Antenna Assembly HWCI and the Real Time Computer HWCI. These additional elements are included to illustrate the connectivity between LOS RF communication equipment.

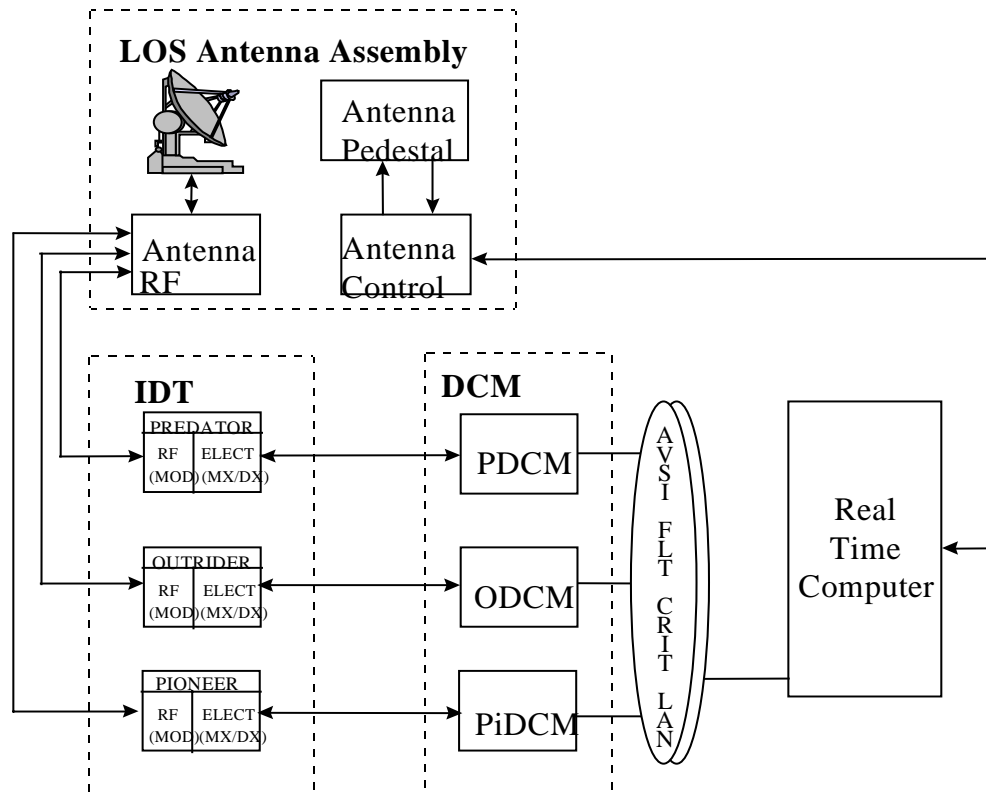


Figure 4.2.1.1.1-1 Integrated Datalink Terminal HWCI Interconnectivity Diagram

The IDT HWCI shall send Common UAV Control CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD107]

The IDT HWCI shall be capable of routing RS170A analog video and digital telemetry data streams to TCS functions. (SSS198) [SSDD108]

Figure 4.2.1.1.1-2 shows the main elements of the IDT component.

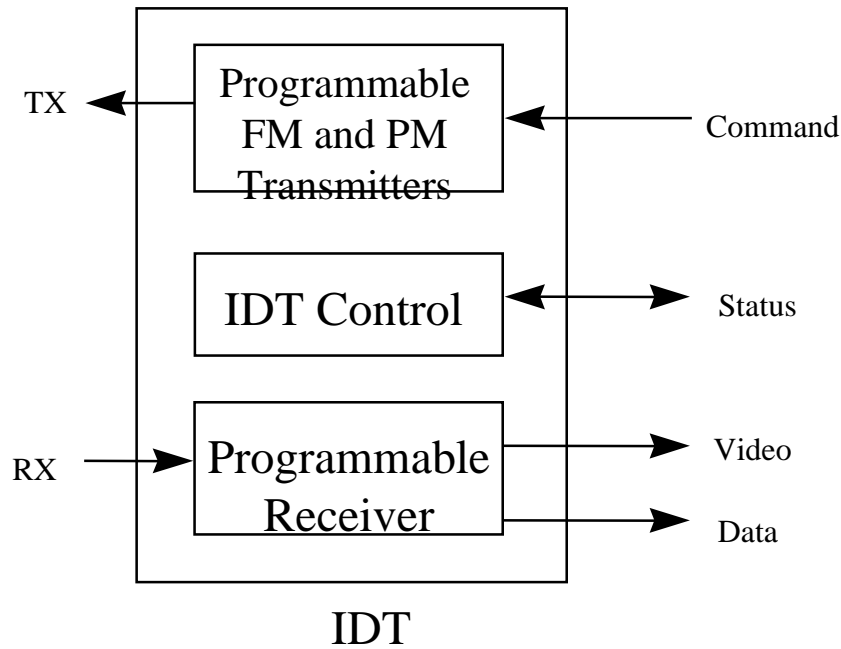


Figure 4.2.1.1.1.1-2 IDT Block Diagram

The maximum size, weight, and power requirements for the IDT HWCI shall not exceed the values shown in Table 4.2.1.1.1.1-1. (SSS374) [SSDD109]

Table 4.2.1.1.1-1 Integrated Datalink Terminal HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.1.2 Ku Datalink Terminal HWCI

The purpose of the Ku Datalink Terminal HWCI is to provide an interface between the DCM HWCI and Ku equipped AVs.

Figure 4.2.1.1.1.2-1 shows a diagram of the Ku Datalink Terminal HWCI in addition to the Ku Antenna Assembly HWCI and the Predator DCM HWCI. These additional elements are included to illustrate the connectivity between Ku RF communication equipment.

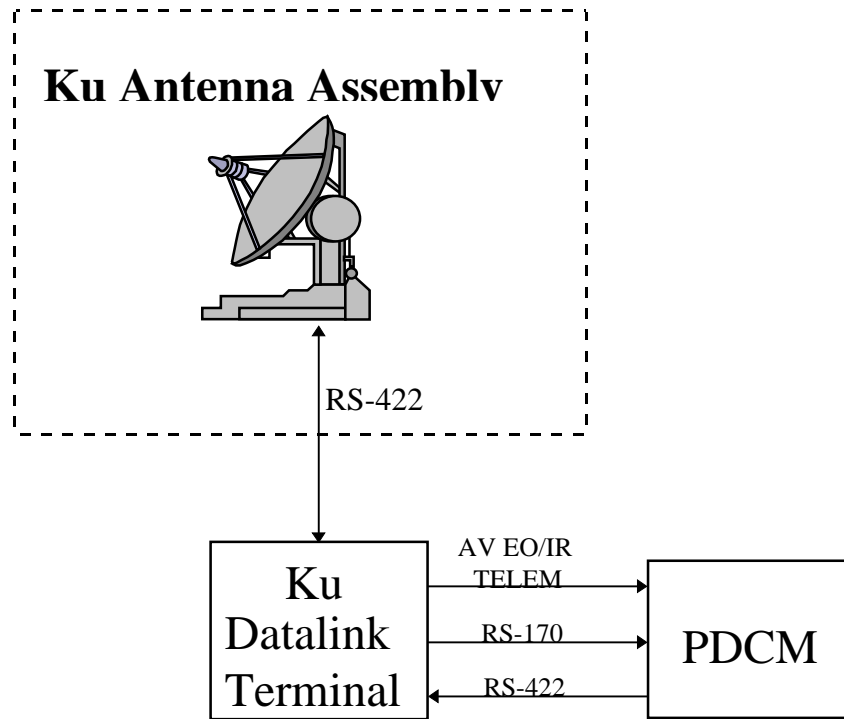


Figure 4.2.1.1.2-1 Ku Datalink Terminal HWCI Interconnectivity Diagram

The Ku Datalink Terminal HWCI to be used with present TCS configurations is the downsized Lockheed Martin terminal. Figure 4.2.1.1.2-2 shows the main elements that comprise the terminal and the associated interconnectivity.

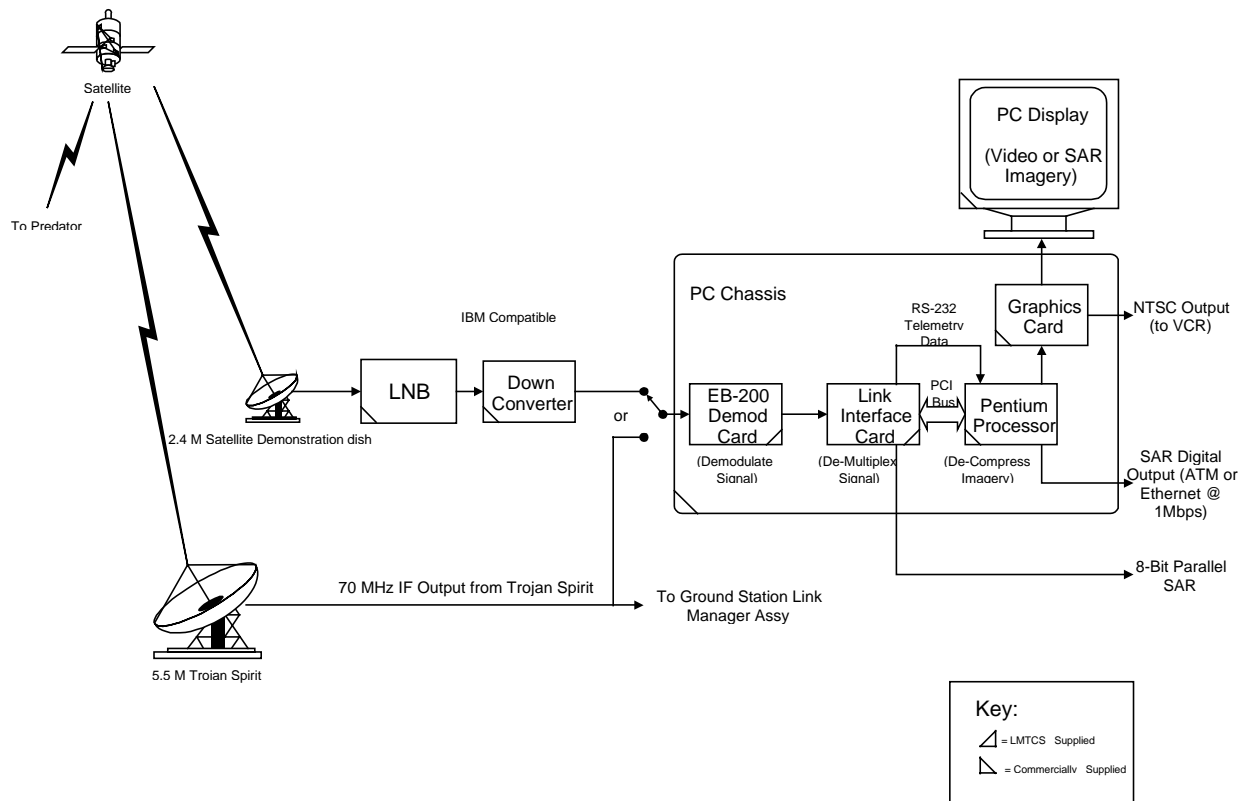


Figure 4.2.1.1.2-2 Lockheed Martin Downsized Terminal Assembly Block Diagram

The Trojan SPIRIT II system's technical characteristics are:

- Configurable for C/Ku-band satellite communications, and X-band in some cases
- Max data rate 512 kbps; nominal 64 to 512 kbps
- Primary shelter, spare equipment module, and mobile antenna platform
- 2.4 meter mobile antenna for V1/3 systems, and 5.5 meter antennas for X-band operations
- Basis of Issue Plan (BOIP): Field to division through theater MI brigades

The Trojan Spirit II Datalink Terminal will be utilized as an alternative solution if required.

The Trojan Spirit II Datalink Terminal can provide up to 14 circuits (8 SCI/6 collateral) using variable baud rates from 4.8 to 512 kbps per channel and will operate on either C, Ku, or X frequency bands.

The Ku Datalink Terminal HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD110]

The Ku Datalink Terminal HWCI shall be capable of routing RS170A analog video and digital telemetry data streams to TCS functions. [SSS198] [SSDD111]

The maximum size, weight, and power requirements for the Ku Datalink Terminal HWCI shall not exceed the values shown in Table 4.2.1.1.2-1. (SSS374) [SSDD112]

Table 4.2.1.1.2-1 Ku Datalink Terminal HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.2 Datalink Control Module HWCI

The purpose of the DCM HWCI is to provide the TCS functionality to perform real-time processing in order to maintain closed-loop communication and control of the AV as well as the required control of ground based datalink components and communication. The TCS will have DCMs for the following AVs: Predator, Outrider, and Pioneer.

The DCM HWCI will be comprised of the Predator DCM (PDCM), Outrider DCM (ODCM), and Pioneer DCM (PiDCM).

The DCM HWCI will transfer data to the RTP CSCI in accordance with the AV Standard Interface (AVSI).

The DCM HWCI shall be initialized upon operator selection of a specific AV for use in ground based closed loop command and control functions. (SSS109)[SSDD113]

4.2.1.1.2.1 Predator Datalink Control Module HWCI

The purpose of the PDCM HWCI is to provide the TCS with the capability to command and control the Predator AV and associated payloads. Figure 4.2.1.1.2.1-1 shows the main elements of the component and the associated interconnectivity.

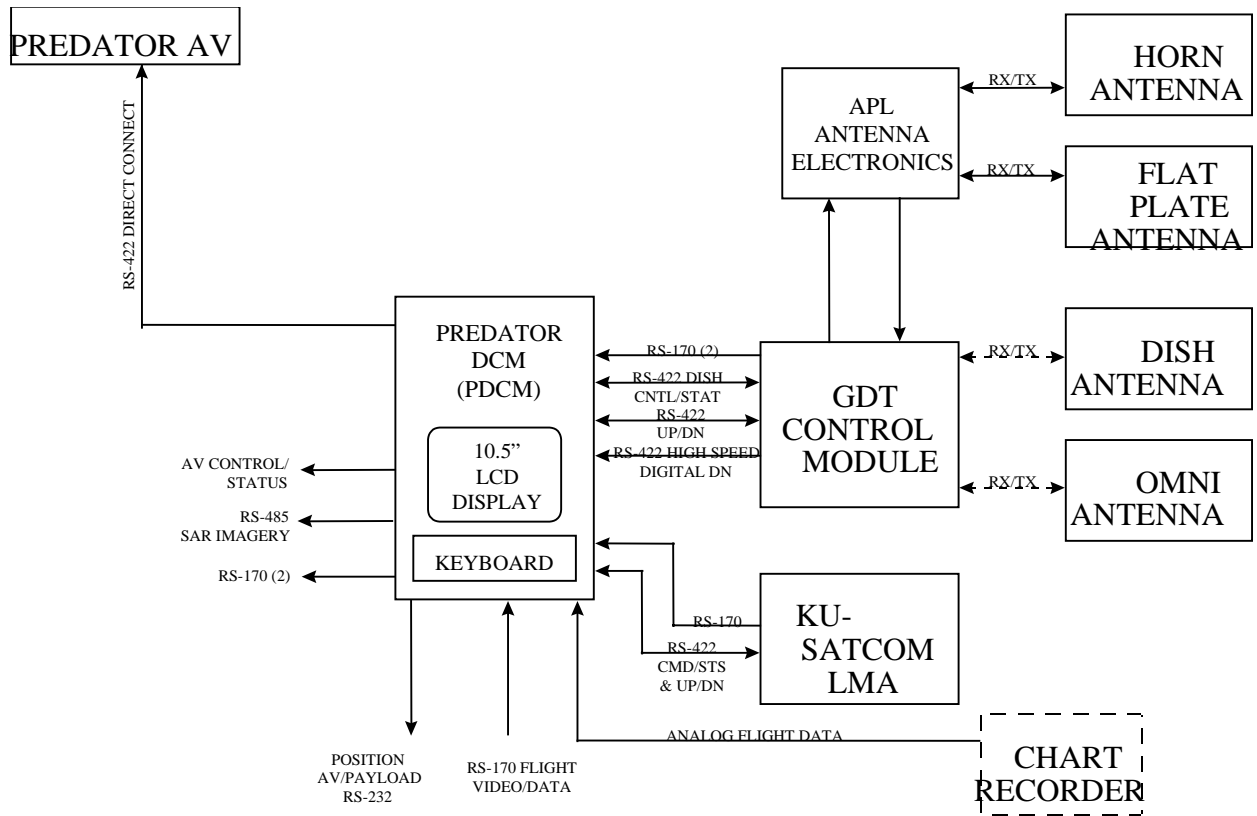


Figure 4.2.1.1.2.1-1 Predator DCM HWCI Interconnectivity Diagram

The PDCM HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036) [SSDD114]

The maximum size, weight, and power requirements for the Predator DCM HWCI shall not exceed the values shown in Table 4.2.1.1.2.1-1. (SSS374) [SSDD115]

Table 4.2.1.1.2.1-1 Predator DCM HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.2.2 Outrider Datalink Control Module HWCI

The purpose of the ODCM HWCI is to provide the TCS with the capability to command and control the Outrider AV and associated payloads. Figure 4.2.1.1.2.2-1 shows the main elements of the component and the associated interconnectivity.

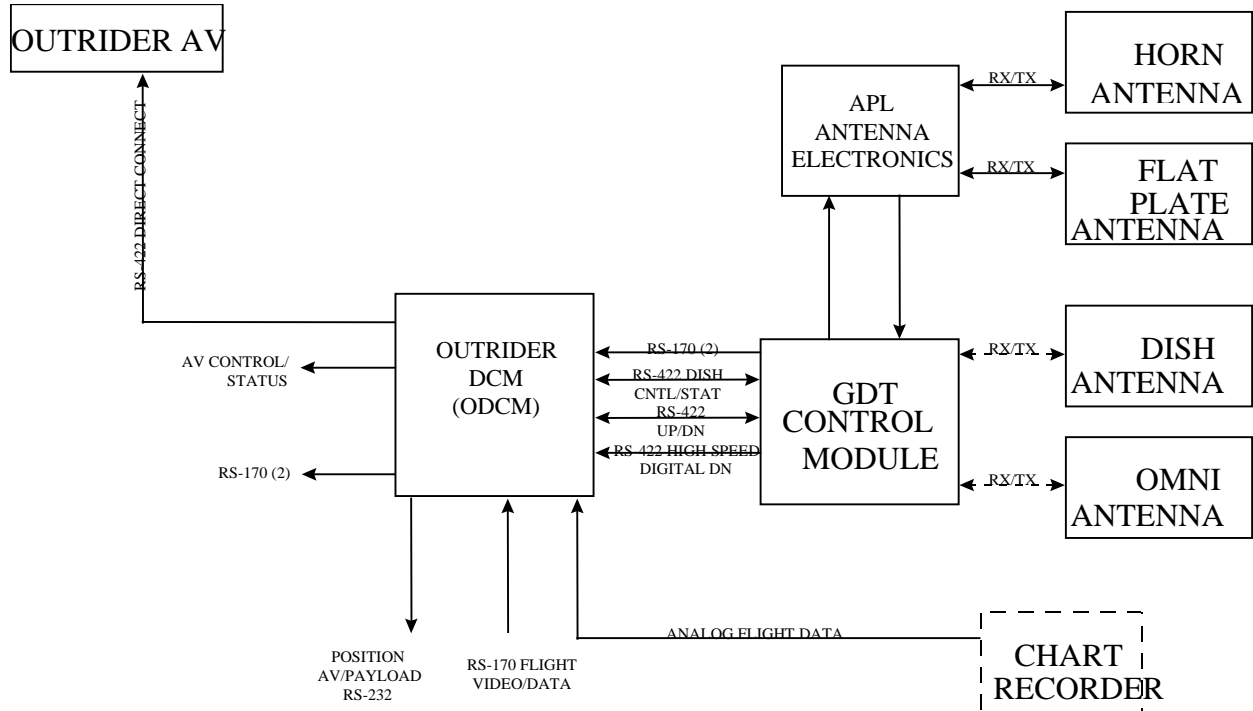


Figure 4.2.1.1.2.2-1 Outrider DCM HWCI Interconnectivity Diagram

The ODCM HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD116]

The maximum size, weight, and power requirements for the Outrider DCM HWCI shall not exceed the values shown in Table 4.2.1.1.2.2-1. (SSS374) [SSDD117]

Table 4.2.1.1.2.2-1 Outrider DCM HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.2.3 Pioneer Datalink Control Module HWCI

The purpose of the Pioneer DCM HWCI is to provide the TCS with the capability to command and control the Pioneer AV and associated payloads. Figure 4.2.1.1.2.3-1 Pioneer Datalink Control Module HWCI Interconnectivity Diagram shows the main elements of the component and the associated interconnectivity

The Pioneer DCM HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD118]

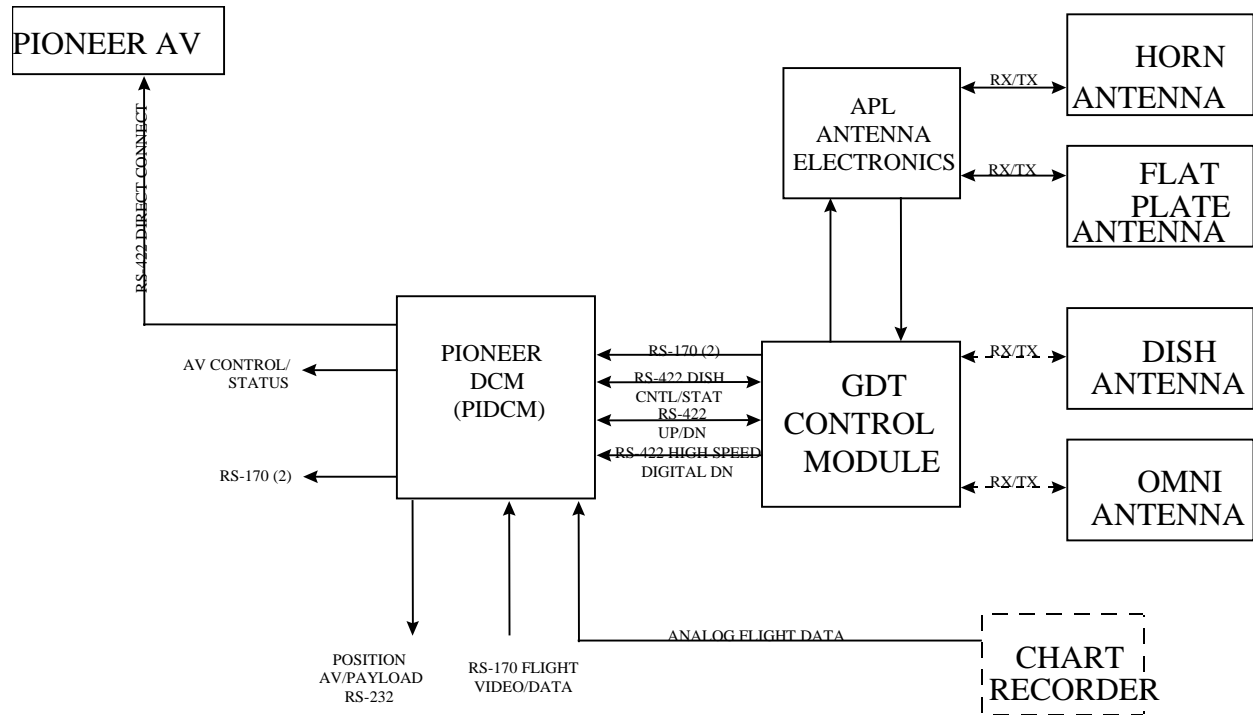


Figure 4.2.1.1.2.3-1 Pioneer Datalink Control Module HWCI Interconnectivity Diagram

The maximum size, weight, and power requirements for the Pioneer DCM HWCI shall not exceed the values shown in Table 4.2.1.1.2.3-1. (SSS374) [SSDD119]

Table 4.2.1.1.2.3-1 Pioneer DCM HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.3 Antenna Assembly HWCIs

The Antenna Assembly HWCIs will include: C-Band Line of Site and Ku-Band SATCOM.

4.2.1.1.3.1 C-Band Line of Site Antenna Assembly HWC

The purpose of the C-Band LOS Antenna Assembly HWC is to provide an antenna system that will allow the TCS to communicate over C-Band LOS to appropriate AVs.

The C-Band LOS Antenna Assembly HWC shall be capable of being situated in a location such that the LOS antenna is not blocked by the surrounding terrain or man made obstructions. (SSS170) [SSDD120]

Figure 4.2.1.1.3.1-1 provides the physical interconnectivity of the antenna assembly and associated components.

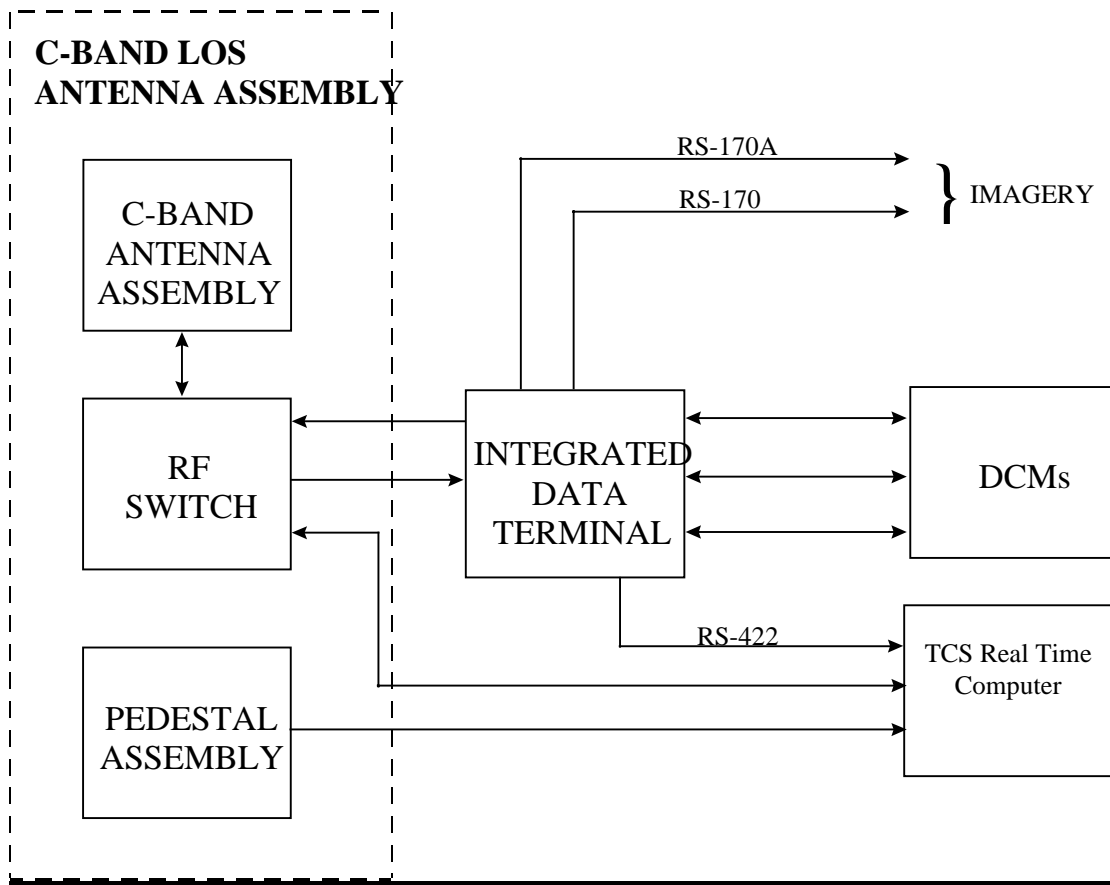


Figure 4.2.1.1.3.1-1 C-Band LOS Antenna Assembly Diagram

The maximum size, weight, and power requirements for the C-Band LOS Antenna Assembly HWCI shall not exceed the values shown in Table 4.2.1.1.3.1-1. (SSS374) [SSDD121]

Table 4.2.1.1.3.1-1 C-Band LOS Antenna Assembly HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.1.3.2 Ku-Band SATCOM Antenna Assembly HWCI

The purpose of the Ku-Band SATCOM Antenna Assembly HWCI is to provide an antenna system that will allow the TCS to communicate over Ku-Band SATCOM to SATCOM capable AVs.

The Ku-Band SATCOM Antenna Assembly HWCI shall be capable of being situated in a location such that the antenna is not blocked by the surrounding terrain or man made obstructions. (SSS170) [SSDD122]

Figure 4.2.1.1.3.2-1 provides the physical interconnectivity of the antenna assembly and associated components.

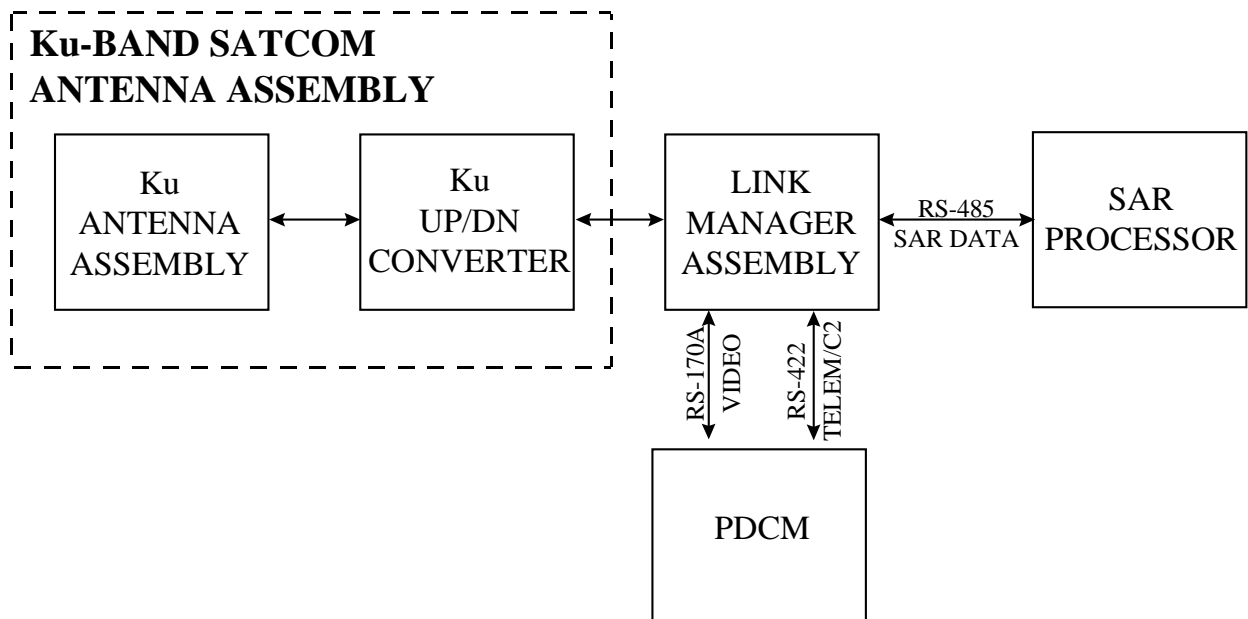


Figure 4.2.1.1.3.2-1 Ku-Band SATCOM Antenna Assembly Diagram

The maximum size, weight, and power requirements for the Ku-Band SATCOM Antenna Assembly HWCI shall not exceed the values shown in Table 4.2.1.1.3.2-1. (SSS374) [SSDD123]

Table 4.2.1.1.3.2-1 Ku-Band SATCOM Antenna Assembly HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.1.2 AV Communications Subsystem Computer Software Configuration Items

The AV Communications Subsystem will consist of the following CSCI: Datalink Control Module.

4.2.1.2.1 Datalink Control Module CSCIs

The DCM CSCIs will consist of the following CSCIs: Predator, Outrider, and Pioneer.

4.2.1.2.1.1 Predator Datalink Control Module CSCI

The PDCM CSCI shall be provided by the PDCM supplier. (SSS312)[SSDD124]

4.2.1.2.1.2 Outrider Datalink Control Module CSCI

The ODCM CSCI shall be provided by the ODCM supplier. (SSS312)[SSDD125]

4.2.1.2.1.3 Pioneer Datalink Control Module CSCI

The PiDCM CSCI shall be provided by the PiDCM supplier. (SSS312)[SSDD126]

4.2.2 Launch and Recovery Subsystem

The Launch and Recovery Subsystem consists of the HWCI and CSCIs necessary for automated launch and recovery functions.

4.2.2.1 Launch and Recovery Subsystem Hardware Configuration Items

The Launch and Recovery Subsystem will consist of the following HWCI: Integrity Beacon Landing System and UAV Common Automated Recovery System.

4.2.2.1.1 Integrity Beacon Landing System HWCI

The purpose of the Integrity Beacon Landing System (IBLS) HWCI is to provide the TCS with a differential Global Positioning System (GPS) launch and recovery system to allow TCS to track and control the recovery of AVs that are IBLS capable. The IBLS HWCI will provide AV guidance and control functions and commands to the Real Time Computer HWCI for transmission to the AV.

The IBLS shall send Common UAV Control the results of its periodic FD/L. (SSS036)[SSDD127]

The maximum size, weight, and power requirements for the IBLs HWCI shall not exceed the values shown in Table 4.2.2.1.1-1. (SSS374) [SSDD128]

Table 4.2.2.1.1-1 IBLs HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.2.1.2 UAV Common Automated Recovery System HWCI

The purpose of the UAV Common Automated Recovery System (UCARS) HWCI is to provide a microwave Ka-band radar-base track system to allow TCS to track and control the recovery of AVs that are UCARS capable. The UCARS HWCI will provide AV guidance and control functions and commands to the Real Time Computer HWCI for transmission to the AV.

The UCARS shall send Common UAV Control the results of its periodic FD/L. (SSS036)[SSDD129]

The maximum size, weight, and power requirements for the UCARS HWCI shall not exceed the values shown in Table 4.2.2.1.2-1. (SSS374) [SSDD130]

Table 4.2.2.1.2-1 UCARS HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.2.2 Launch and Recovery Subsystem Computer Software Configuration Items

The Launch and Recovery Subsystem contains no CSCIs.

4.2.3 Real Time Subsystem

The Real Time Subsystem consists of the HWCI and CSCIs necessary for real time processing of information.

4.2.3.1 Real Time Subsystem Hardware Configuration Items

The Real Time Subsystem will consist of the following HWCI: Real Time Computer HWCI and Manual Controls HWCI.

4.2.3.1.1 Real Time Computer HWCI

The purpose of the Real Time Computer HWCI is to provide the real time processing capability to the TCS. Figure 4.2.3.1.1-1 shows the main elements of the component and the associated interconnectivity.

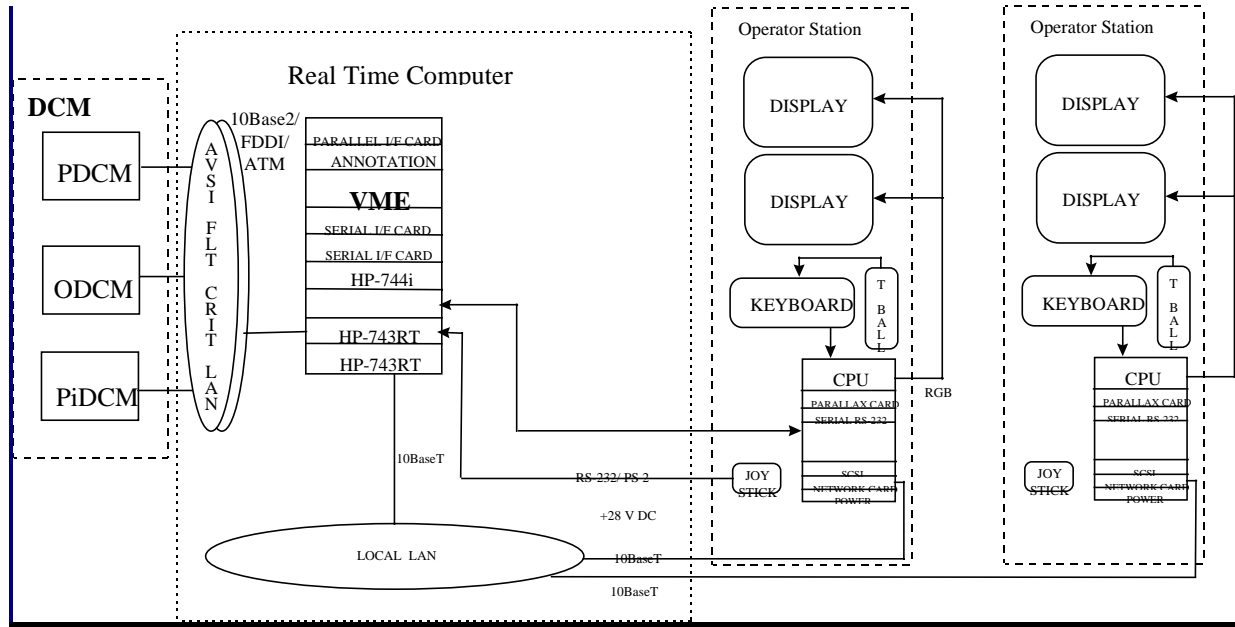


Figure 4.2.3.1.1-1 Real Time Computer HWCI Interconnectivity Diagram

The maximum size, weight, and power requirements for the Real Time Computer HWCI shall not exceed the values shown in Table 4.2.3.1.1-1. (SSS374) [SSDD131]

Table 4.2.3.1.1-1 Real Time Computer HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.3.1.2 Manual Controls HWCI

TBD.

The maximum size, weight, and power requirements for the Manual Controls HWCI shall not exceed the values shown in Table 4.2.3.1.2-1. (SSS374) [SSDD132]

Table 4.2.3.1.2-1 Manual Controls HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.3.2 Real Time Subsystem Computer Software Configuration Items

The Real Time Subsystem will consist of the following CSCIs: Real Time Processes CSCI and TCS Data Server CSCI.

4.2.3.2.1 Real Time Processes CSCI

The Real Time Processes (RTP) CSCI will consist of the following basic elements:

1. Antenna Control
2. AVSI Conversion
3. UCARS Conversion
4. IBLIS Conversion

4.2.3.2.1.1 Antenna Control

TBD.

4.2.3.2.1.2 Air Vehicle Standard Interface Conversion

The RTP CSCI shall provide the capability to monitor specific telemetry elements in real-time, and record all or selected telemetry elements for future review or processing. (SSS140) [SSDD133]

The RTP CSCI shall provide the system functionality necessary to receive (SSS287) [SSDD134] and interpret mission function data from the DCM HWCI. (SSS312) [SSDD135]

4.2.3.2.1.3 UAV Common Automated Recovery System Conversion

The RTP CSCI shall provide the functionality necessary to process data from the UCARS HWCI. (SSS289) [SSDD136]

4.2.3.2.1.4 Integrity Beacon Landing System Conversion

The RTP CSCI shall provide the functionality necessary to process data from the IBLS HWCI. (SSS289) [SSDD137]

4.2.3.2.2 TCS Data Server CSCI

The TCS Data Server CSCI will reside on the real time computer for levels 4 & 5 of TCS interaction.

The TCS Data Server CSCI shall be configured to support information flow both to and from the AV. (SSS325) [SSDD138]

The TCS Data Server CSCI shall have internal interfaces with all other CSCIs (SSS326) [SSDD139] allowing information from the data server to be made available to other components of the TCS. (SSS327) [SSDD140]

The TCS Data Server CSCI shall support a distributed processing capability (SSS328) [SSDD141]; such that, remotely hosted TCS applications shall communicate in a client server relationship. (SSS329) [SSDD142]

The SAR data received by the Data Server CSCI over the High/Low LAN shall be distributed to other TCS CSCIs. (SSS330) [SSDD143]

The TCS Data Server shall provide automatic recording of all TCS Data Server state data, internal interface communications, and other information necessary to support event reconstruction. (SSS528) [SSDD144]

4.2.4 Payload Subsystem

The Payload Subsystem will consist of the following payloads: EO/IR and SAR.

4.2.4.1 EO/IR Payload

The EO/IR Payload does not have any HWCI's or CSCIs specific to TCS.

4.2.4.2 SAR Payload

The SAR Payload consists of the HWCI's and CSCIs necessary for SAR payload operations.

4.2.4.2.1 SAR Payload Hardware Configuration Items

The SAR Payload consists of the following HWCI's: SAR Processor, Digital Linear Tape Drive, Redundant Array of Inexpensive Disks (RAID), and Link Manager Assembly (LMA).

4.2.4.2.1.1 SAR Processor HWCI

The purpose of the SAR Processor HWCI is to provide front end processing of raw SAR data to include telemetry and imagery for input into the NRT Computer HWCI. Figure 4.2.4.2.1.1-1 shows its connectivity with other TCS HWCI.

The SAR Processor shall send Common UAV Control CSCI the results of its periodic FD/L. (SSS036) [SSDD145]

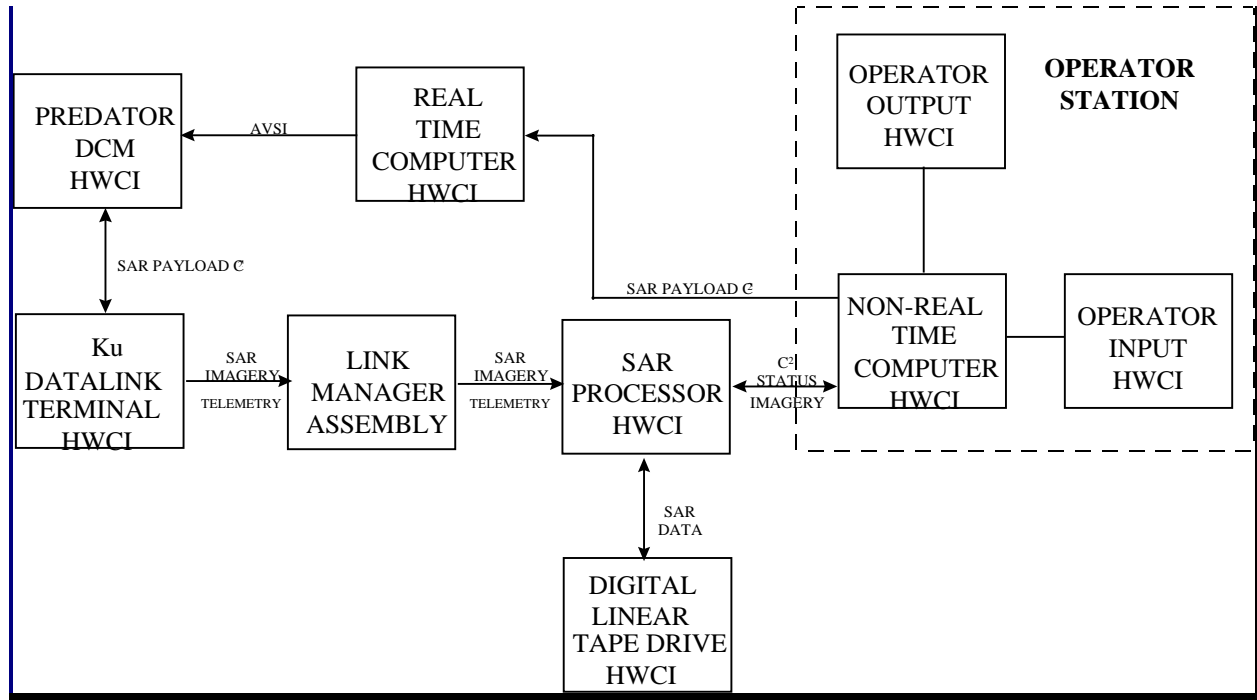


Figure 4.2.4.2.1.1-1 SAR Processor HWCI Interconnectivity Diagram

The maximum size, weight, and power requirements for the SAR Processor HWCI shall not exceed the values shown in Table 4.2.4.2.1.1-1. (SSS374) [SSDD146]

Table 4.2.4.2.1.1-1 SAR Processor HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.4.2.1.2 Digital Linear Tape Drive HWCI

The purpose of the Digital Linear Tape Drive HWCI is to provide TCS the ability to record raw SAR data.

The Digital Linear Tape Drive shall send Common UAV Control the results of its periodic FD/L. (SSS036)[SSDD147]

The maximum size, weight, and power requirements for the Digital Linear Tape Drive HWCI shall not exceed the values shown in Table 4.2.4.2.1.2-1. (SSS374) [SSDD148]

Table 4.2.4.2.1.2-1 Digital Linear Tape Drive HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.4.2.1.3 Redundant Array of Inexpensive Disks HWCI

The Redundant Array of Inexpensive Disks HWCI shall provide TCS a buffer storage device for approximately 10 minutes of SAR data. (SSS343) [SSDD149]

The maximum size, weight, and power requirements for the RAID HWCI shall not exceed the values shown in Table 4.2.4.2.1.3-1. (SSS374) [SSDD150]

Table 4.2.4.2.1.3-1 RAID HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.4.2.1.4 Link Manager Assembly HWCI

The purpose of the Link Manager Assembly (LMA) HWCI is TBD.

The maximum size, weight, and power requirements for the LMA HWCI shall not exceed the values shown in Table 4.2.4.2.1.4-1. (SSS374) [SSDD151]

Table 4.2.4.2.1.4-1 LMA HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.4.2.2 SAR Payload Computer Software Configuration Items

The SAR Payload CSCI consists of the following basic elements

1. SAR Payload Control
2. SAR Imagery Viewer
3. SAR Imagery Data Acquisition
4. NITF Files

4.2.4.2.2.1 SAR Payload Control

The SAR Payload CSCI shall be interoperable with SAR payloads. (SSS013) [SSDD152]

The SAR Payload CSCI shall have the capability to control and monitor the SAR payload. (SSS147) [SSDD153]

4.2.4.2.2.2 SAR Imagery Viewer

The SAR Payload CSCI shall have the functionality to process payload product data from SAR payloads. (SSS182) [SSDD154]

The SAR Payload CSCI shall be able to store up to 24 hours of SAR payload imagery and associated telemetry data. (SSS184) [SSDD155]

4.2.4.2.2.3 SAR Imagery Data Acquisition

The SAR Payload CSCI shall have the functionality to process payload product data to include correlating, formatting, storing, and internally routing payload information. (SSS182) [SSDD156]

4.2.4.2.2.4 NITF Files

The SAR Payload CSCI shall be in compliance with CIGSS, United States Imagery Standards (USIS), NITF Version 2.0 and Global Command Control Systems (GCCS) when processing payload imagery data. (SSS185) [SSDD157]

The NITF 2.0 imagery files generated by SAR CSCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS186) [SSDD158]

4.2.5 Operator Station Subsystem

The Operator Station Subsystem consists of the HWCI and CSCIs necessary for non-real time processing and control of the TCS.

4.2.5.1 Operator Station Subsystem Hardware Configuration Items

The Operator Station Subsystem will consist of the following HWCI: Non-Real Time Computer, Video Support, VCR, Operator Output, and Operator Input.

The Operator Output Operator Input HWCI shall provide display(s), that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059)[SSDD159]

4.2.5.1.1 Non-Real Time Computer HWCI

The NRT Computer HWCI will provide the Processing Capacity which allows TCS to perform TCS functionality to include but not limited to: Mission Planning, Mission Control and Monitoring, Payload Processing, Targeting and C4I Interfacing.

The NRT Computer HWCI shall have the minimum characteristics as described in Table 4.2.5.1.1-1. (SSS009) [SSDD160]

Table 4.2.5.1.1-1 Minimum Non-Real Time Computer Characteristics

| Computer Characteristic | TAC-4 | SPARC 20 |
|--------------------------------|--|------------------------------------|
| CPU Processor | 120 MHz PA-RISC 7200 | Dual 150 MHz |
| RAM | 320 MB | 256 MB |
| CPU Throughput | TBD | TBD |
| Hard Disk (Internal) | 2 GB Fast Wide SCSI 1 GB Fast Wide SCCI | 2 GB |
| CD-ROM | 4x | 4x |
| Tape Drive | 4 mm | 4 mm |
| Video Capture | Parallax | Parallax |
| Additional Processor Cards | FDDI/Ethernet | FDDI |
| Interfaces | AUI LAN Interface External SCSI | AUI LAN Interface External SCSI |
| Ports | RS-232C Parallel Printer | A&B Serial |

The NRT Computer HWCI shall be capable of storing a minimum of 500 mission plans under unique names to allow for later retrieval. (SSS058)[SSDD161]

The NRT Computer HWCI shall allow access to other computers via network interfaces to share in processing capability. (SSS377) [SSDD162]

The NRT Computer HWCI shall allow for multiple external peripherals including printers and scanners. (SSS378) [SSDD163]

The NRT Computer HWCI shall have a read and write CD drive for storage and retrieval of TCS data. (SSS341)[SSDD164]

The NRT Computer HWCI shall provide a tape drive for storage and retrieval of TCS data. (SSS342)[SSDD165]

To meet the growth requirements the NRT Computer HWCI shall be capable of adding additional storage media such as tape, disk, and CD drive, without major hardware reconfiguration. (SSS383) [SSDD166]

The NRT Computer HWCI shall be able to read data from National Imagery and Mapping Agency (NIMA), CD-ROM Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), and embedded training media available on CD-ROM media. (SSS384) [SSDD167]

The NRT Computer HWCI throughput shall not exceed 50% of the throughput capability delivered over any 10 second period. (SSS389) [SSDD168]

The NRT Computer HWCI shall be capable of providing, as an objective, 25% of throughput capability delivered over any 10 second period. (SSS390) [SSDD169]

The NRT Computer HWCI shall be capable of providing a 50% spare memory storage capacity over delivered storage used. (SSS391) [SSDD170]

As an objective, the NRT Computer HWCI shall be capable of providing, 75% spare memory storage capacity over storage used. (SSS392) [SSDD171]

The NRT Computer HWCI shall have the capability to import as well as create and modify map display overlays for fire support coordination measures. (SSS547) [SSDD172]

The maximum size, weight, and power requirements for the NRT Computer HWCI shall not exceed the values shown in Table 4.2.5.1.1-2. (SSS374) [SSDD173]

Table 4.2.5.1.1-2 NRT Computer HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.5.1.2 Video Support HWCI

The purpose of the Video Support HWCI is to provide the capability to receive, amplify, convert, annotate, display, and distribute analog video. In addition, the Video Support HWCI provides the capability to capture freeze frames of the analog video and store, retrieve, and display the freeze frames. The Video Support HWCI will be procured as a Commercial Off-The-Shelf (COTS) item. Figure 4.2.5.1.2-1 identifies the elements of the component and shows the associated interconnectivity.

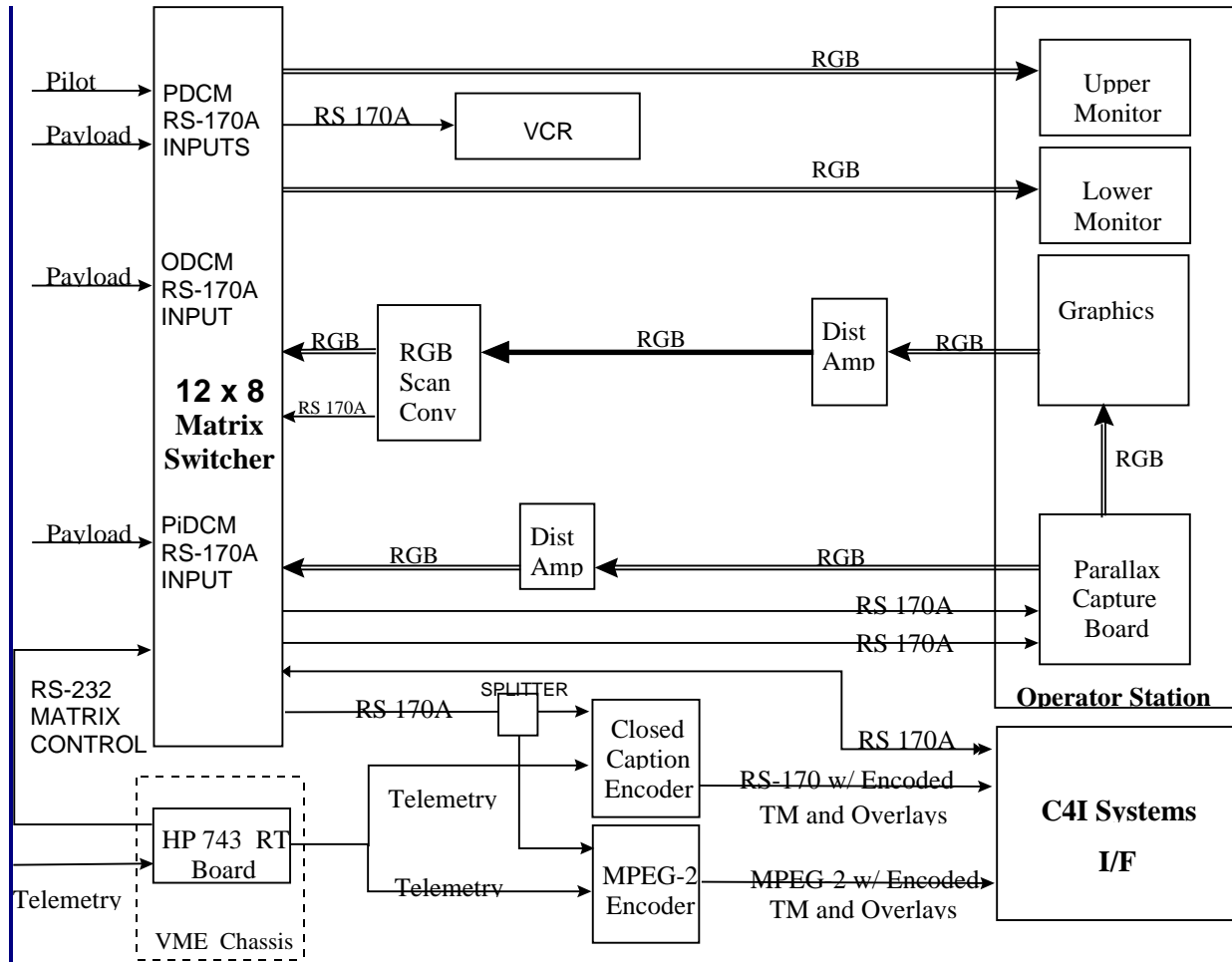


Figure 4.2.5.1.2-1 Video Support HWCI Interconnectivity Diagram

The TCS Video Support HWCI shall be to overlay the video imagery with overlays to include, as a minimum, date/time group, target location coordinates when the target is in the center of the field of view, north seeking arrow, and AV position and heading. (SSS203)[SSDD174]

The TCS Video Support HWCI shall be capable of providing video with or without overlays to connected C4I systems and to other TCSs. (SSS335) [SSDD175]

The Video Support HWCI shall provide the hardware capacity to convert Payload imagery as necessary so it is in compliance with CIGSS, USIS, NITF 2.0 and GCCS. (SSS185)[SSDD176]

The NITF 2.0 imagery files generated by the Video Support HWCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS186) [SSDD177]

Video Support shall send Common UAV Control CSCI the results of its periodic FD/L if supported by the HWCI. (SSS036) [SSDD178]

The VCR HWCI shall be able to record and playback downlinked video with or without overlaid telemetry data. (SSS195) [SSDD179]

The TCS shall export and disseminate formatted NITF 2.0 files. (SSS558) [SSDD180]

The maximum size, weight, and power requirements for the Video Support HWCI shall not exceed the values shown in Table 4.2.5.1.2-2. (SSS374) [SSDD181]

Table 4.2.5.1.2-2 Video Support HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.5.1.2.1 VCR HWCI

The purpose of the VCR HWCI is to provide the TCS with the ability to record and playback analog video payload data.

The VCR HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD182]

The maximum size, weight, and power requirements for the VCR HWCI shall not exceed the values shown in Table 4.2.5.1.2.1-1. (SSS374) [SSDD183]

Table 4.2.5.1.2.1-1 VCR HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.5.1.3 Operator Output HWCI

The purpose of the Operator Output HWCI is to provide the necessary hardware to allow the operator(s) of TCS to receive information from the NRT Computer HWCI. The Operator Output HWCI will consist of one or more visual display devices.

The Operator Output HWCI shall support the operator with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD184]

The Operator Output HWCI shall send Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD185]

The Operator Output HWCI shall support redundancy in all operator interface operations, so that the loss of any one display output device does not prohibit operation of any TCS function. (SSS463)[SSDD186]

The Operator Output HWCI shall provide a minimum of TBD (450) square inches of display surfaces area. The resolution of all displays shall be a minimum of TBD (6.4 x 8.2) pixels per square inch. Each display shall have a minimum of 256 colors. Each display shall have the equivalent of TBD (16) shades of gray. (SSS446)[SSDD187]

The Operator Output HWCI shall have monitor(s) that provide easy reading of displays under direct sunlight and low light level environments. (SSS446) [SSDD188] Display jitter and flicker shall not be perceptible by the operator. (SSS459) [SSDD189]

The Operator Output HWCI shall have, at a minimum, the functionality to display the following four display windows: (SSS405) [SSDD190]

- i. Display to provide aircraft position, TCS position, flight path, and waypoint graphics in the foreground which are positioned in relation to a map displayed in the background
- ii. Display to provide aircraft flight data or payload data in the foreground, and downlinked video in the background
- iii. Display to provide graphic presentations of downlinked telemetry data
- iv. Display to present the interface menus for NRT Computer software

The maximum size, weight, and power requirements for the Operator Output HWCI shall not exceed the values shown in Table 4.2.5.1.3-1. (SSS374) [SSDD191]

Table 4.2.5.1.3-1 Operator Output HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.5.1.4 Operator Input HWCI

The purpose of the Operator Input HWCI is to provide the necessary hardware to allow the operator(s) of TCS to input information into the NRT Computer HWCI. The Operator Input HWCI will consist of, as a minimum, the following elements: keyboard, trackball, and joystick.

The Operator Input HWCI shall provide the operator with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD192]

The Operator Input HWCI shall send Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD193]

The Operator Input HWCI shall provide input devices, that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059)[SSDD194]

The Operator Input HWCI shall support redundancy in all operator interface operations, so that the loss of any one HCI input device does not prohibit operation of any TCS function. (SSS463)[SSDD195]

The Operator Input HWCI shall include an off-the-shelf, complex control joystick with at least two X/Y control devices, multiple toggle and multi-position switches as part of the Operator Input HWCI. (SSS468)[SSDD196]

The Operator Input HWCI shall have ergonomically designed operator controls for the 5th percentile female to 95th percentile male operator. (SSS443)[SSDD197]

The Operator Input HWCI controls shall allow an operator performing all air vehicle, payload, and C4I Communication activities while wearing or not wearing cold weather clothing and in a MOPP. (SSS444)[SSDD198]

The maximum size, weight, and power requirements for the Operator Input HWCI shall not exceed the values shown in Table 4.2.5.1.4-1. (SSS374) [SSDD199]

Table 4.2.5.1.4-1 Operator Input HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.5.2 Operator Station Subsystem Computer Software Configuration Items

The operator station subsystem CSCIs consist of the following CSCIs: Common UAV Control CSCI, TCS Mission Planner CSCI, DII/COE CSCI, C4I Interface CSCI, FD/L & Diagnostics, and AV Diagnostics.

4.2.5.2.1 Common UAV Control CSCI

The Common UAV Control CSCI shall provide the UAV operator with the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, and data dissemination. (SSS397) [SSDD200]

The Common UAV Control CSCI shall provide automatic recording of all Common UAV Control state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD201]

The Common UAV Control CSCI will consist of the following basic elements:

1. System Setup
2. TCS Main
3. AV Control
4. AV Flight Monitoring
5. Datalink Management and Control
6. Electro-Optical/Infrared (EO/IR) Payload Control
7. EO/IR Imagery Viewer
8. EO/IR Imagery Data Acquisition
9. C4I Messages
10. NITF Files
11. Targeting
12. Collection Tasking and Retasking
13. Launch and Recovery
14. Training
15. Maintenance

4.2.5.2.1.1 System Setup

The following TCS requirements are allocated to the System Status element of the Common UAV Control CSCI:

- TCS States and Modes and top level function control:
 - Start up processing control
 - Power-down processing control
 - Activation of other Software Tasks and Functions
 - Termination of other Software Tasks and Functions
 - Activation of other Hardware Tasks and Functions
 - Termination of other Hardware Tasks and Functions
- HCI Requirements

The Common UAV Control CSCI shall provide and control the TCS states of operation, Startup, Operation, and Shutdown. (SSS014)[SSDD202]

The Common UAV Control CSCI shall control the activation and termination of all TCS CSCIs via the DII/COE. (SSS027)[SSDD203]

The Common UAV Control CSCI shall ensure that the TCS states of operation do not exist concurrently. (SSS015)[SSDD204]

Figure 4.2.5.2.1.1-1 shows the TCS states of operation.

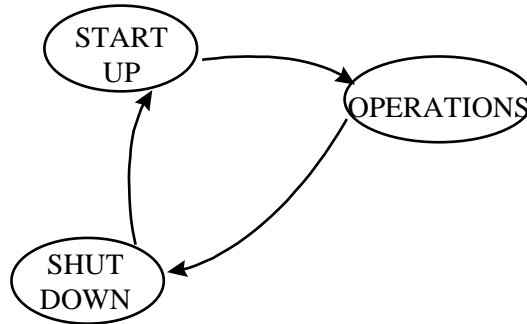


Figure 4.2.5.2.1.1-1 TCS State Diagram

Upon application of power, the Common UAV Control CSCI shall insure that the TCS safely enters the Startup State. (SSS016)[SSDD205]

The Startup State shall be comprised of the following modes: Normal Startup Mode, and Recovery Startup Mode. (SSS017)[SSDD206]

Figure 4.2.5.2.1.1-2 shows the modes that exist in the Startup State.

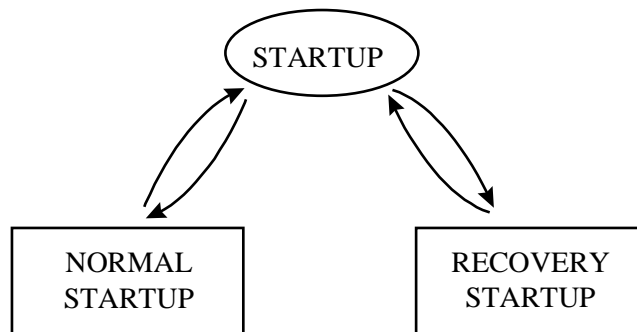


Figure 4.2.5.2.1.1-2 TCS Startup State and Associated Modes Diagram

Upon application of power, the Common UAV Control shall enter the Normal Startup Mode provided the TCS last termination was normal. (SSS019)[SSDD207]

Upon application of power, the Common UAV Control shall enter the Recovery Startup Mode provided the TCS last termination was due to an unplanned power interruption or abnormal program termination. (SSS020)[SSDD208]

During startup, the Common UAV Control CSCI shall determine which of the 5 levels of interaction are achievable by the TCS configuration being used. (SSS021)[SSDD209]

When executing in the Normal Start-up Mode, the Common UAV Control CSCI shall provide the system functionality necessary to execute the Start-up FD/L and initialize the system to place it in the UAV independent Operations State within 60 seconds. (SSS024)[SSDD210]

When executing in the Normal Start-up Mode, the Common UAV Control CSCI shall include startup of the TCS HWCIs (SSS542)[SSDD211], as necessary downloading of software (SSS026)[SSDD212], activation of CSCIs (SSS027)[SSDD213], execution of Startup FD/L (SSS025)[SSDD214], and establishment of the state of readiness of all interfaces (SSS028)[SSDD215], and any additional actions required for the TCS to enter the Operations State.

When executing in the Recovery Startup Mode, the Common UAV Control CSCI shall be capable of resuming normal operations, with all parameters set to the last valid values stored on the Hard disk, within 45 seconds of receiving transition to Normal Mode. (SSS029)[SSDD216]

When executing in the Recovery Startup Mode, the Common UAV Control CSCI shall include startup of TCS HWCIs (SSS543)[SSDD217], as necessary downloading of software (SSS544)[SSDD218], activation of CSCIs (SSS545)[SSDD219], establishment of the state of readiness of all interfaces (SSS546)[SSDD220], and any additional actions required for the TCS to enter the Operations State.

For recovery from abnormal termination periods of less than a programmable time (T1), the Common UAV Control CSCI shall resume the previous Operations State and associated functions, using the last valid data stored prior to the abnormal termination. (SSS030)[SSDD221]

For recovery from abnormal termination periods of greater than time T1, the Common UAV Control CSCI shall prompt the operator via the Operator Output and Input HWCIs to select the type of recovery to be executed: (1)Resume In The Same Modes And Data; (SSS031)[SSDD222] (2)Resume in the Same Modes but Review and Modify the Command Data as Necessary (SSS031)[SSDD223]; or (3) Perform a Command Shutdown and Startup Via the Normal Startup Mode.(SSS031)[SSDD224]

When in the Operations State, the Common UAV Control CSCI shall provide a minimum of three modes: normal operations mode, training operations mode, and maintenance operations mode. (SSS032)[SSDD225]

Figure 4.2.5.2.1.1-3 shows the different modes of operation for TCS.

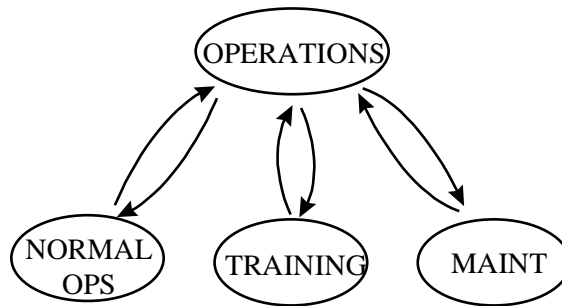


Figure 4.2.5.2.1.1-3 TCS Operations State and Associated Modes Diagram

The Common UAV Control CSCI shall provide the operator, via the Operator Output and Input HWCIs, with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD226]

Upon the receipt of a shutdown command, the Common UAV Control CSCI shall enter the Shutdown State within TBD seconds, which will cause the TCS to be placed in a condition where power can be removed without impacting operations or causing damage to the system, and from which restart of the system can be accomplished normally. (SSS043)[SSDD227]

The Common UAV Control CSCI shall ensure that shutdown of the TCS includes storage or deletion, as specified by the operator, of mission data files (SSS044)[SSDD228], shutdown of appropriate functions (SSS045)[SSDD229], shutdown of the TCS HWCIs (SSS046)[SSDD230], and proper termination of all active interfaces. (SSS047)[SSDD231]

The Common UAV Control CSCI shall activate Startup FD/L as part of normal Start-up Mode. (SSS250)[SSDD232]

The Common UAV Control CSCI shall provide the processing capability to exercise FD/L as part of normal Start-up Mode. (SSS250)[SSDD233]

Start-up FD/L processing provided by the Common UAV Control CSCI shall exercise the TCS Configuration Items so that a minimum fault detection of TBD% of all mission critical failures with a false alarm rate not to exceed TBD% is provided. (SSS254)[SSDD234]

Startup FD/L processing provided by the Common UAV Control CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS255)[SSDD235]

The remaining mission critical failures detected but not isolated by Start-up FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the Common UAV Control CSCI. (SSS256)[SSDD236]

Likewise, Start-up FD/L in the Common UAV Control CSCI shall fault detect TBD% of all non-

mission critical failures with a false alarm rate not to exceed TBD%. (SSS257)[SSDD237]

Start-up FD/L in the Common UAV Control CSCI shall isolate TBD% of all detected non-mission critical failures to a single LRU. (SSS258)[SSDD238]

The remaining non-mission critical failures detected but not isolated by Start-up FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the Common UAV Control CSCI. (SSS259)[SSDD239]

4.2.5.2.1.2 TCS Main

The following TCS requirements are allocated to the TCS Main element of the Common UAV Control CSCI:

- Support scalability to meet user's level of interaction needs
- Prevent users from entering interaction levels not supported by the available HW configuration
- Activities and Processes Log
- HCI Requirements

The Common UAV Control CSCI shall prohibit levels of interaction higher than that achievable by a particular TCS configuration. (SSS022)[SSDD240]

The Common UAV Control CSCI shall inform the operator if the operator attempts to execute a function that is prohibited based upon the determined level of interaction. (SSS023)[SSDD241]

The Common UAV Control CSCI shall periodically receive and process the results of periodic FD/L from the Maintenance element of the Common UAV Control CSCI, while in the Normal Operations Mode and Training Mode. (SSS036)[SSDD242]

The Common UAV Control CSCI shall periodically determine the level of interactions that TCS can support. (SSS036)[SSDD243]

The Common UAV Control CSCI shall have the functionality to receive status information from the C4I Interfaces CSCI to determine C4I interaction availability. (SSS239)[SSDD244]

The Common UAV Control CSCI shall restrict the operator(s) from exercising levels of interaction not achievable by the system. (SSS403)[SSDD245]

4.2.5.2.1.3 AV Control

The following TCS requirements are allocated to the AV Control element of the Common UAV Control CSCI:

- Generic and specific safety of flight processing
- Dynamic inflight mission plan modification
- Support for multiple AV systems and the five levels of interaction
- AV hand-off
- HCI requirements

While simultaneously flying two AVs of different types, the Common UAV Control CSCI shall provide full automated control functionality for each AV. (SSS108)[SSDD246]

The Common UAV Control CSCI shall have the capability to sequentially control multiple AVs of the same or different types. (SSS112)[SSDD247]

The Common UAV Control CSCI shall provide the capability to pass control of an AV to another TCS or AV specific GCS (SSS114)[SSDD248], or take control of an AV from another TCS or AV specific GCS. (SSS115)[SSDD249]

The Common UAV Control CSCI flight controls shall provide operator commanded (SSS118)[SSDD250] and autonomous control with operator override. (SSS118)[SSDD251]

The Common UAV Control CSCI shall provide the capability to control the flight of the selected AV in accordance with the specific AV's operational performance capabilities. (SSS120)[SSDD252]

The Common UAV Control CSCI shall provide the capability to enter AV preset limits which, as a minimum, will include airspeed limits, altitude limits, and fuel limits. (SSS122)[SSDD253]

The Common UAV Control CSCI shall only support operation of the AV via autopilot flight modes, and will not provide the operator the capability to directly manipulate AV flight surfaces. (SSS126)[SSDD254]

The Common UAV Control CSCI shall provide interactive displays necessary to command the flight of an AV. (SSS127)[SSDD255]

The Common UAV Control CSCI shall allow the operator to control the flight behavior characteristics inherent to the selected AV. (SSS128)[SSDD256]

Table 4.2.5.2.1.3-1 shows the expected flight behavior characteristics for known and future UAVs.

Table 4.2.5.2.1.3-1 UAV Flight Behavior Characteristics

| FLIGHT BEHAVIOR CHARACTERISTICS | UAV |
|--|------------|
| Heading | Predator |
| Airspeed | TBD |
| Altitude | TBD |
| Weight | TBD |
| Time on Station | TBD |
| Fuel Load | TBD |
| Heading | Outrider |
| Airspeed | TBD |
| Altitude | TBD |
| Weight | TBD |
| Time on Station | TBD |
| Fuel Load | TBD |
| | Future |

The Common UAV Control CSCI shall provide the operator the capability to initiate or change flight behaviors by sending the proper control commands to the AV. (SSS129)[SSDD257]

The Common UAV Control CSCI shall have the capability to command the AV to use the navigation methods inherent to the selected AV. (SSS130)[SSDD258]

Table 4.2.5.2.1.3-2 shows the expected navigation methods for known and future AVs.

Table 4.2.5.2.1.3-2 UAV Navigation Methods

| NAVIGATION METHOD | UAV |
|----------------------------------|-------------------|
| Inertial Navigation System (INS) | Predator |
| Global Positioning System (GPS) | Predator/Outrider |
| Integrated INS/GPS | Future |

The Common UAV Control CSCI shall provide the operator the capability to initiate or change AV navigation methods by sending the proper control commands to the AV. (SSS131)[SSDD259]

The Common UAV Control CSCI shall support an automatic launch and recovery system. (SSS135)[SSDD260]

The Common UAV Control CSCI shall be interoperable with IBLS (SSS136)[SSDD261], and UCARS. (SSS137)[SSDD262]

The Common UAV Control CSCI shall present sufficient cues to the operator to implement and monitor automatic launch and recovery, and to initiate abort procedures if required. (SSS138)[SSDD263]

The Common UAV Control CSCI shall allow the operator to initiate the emergency recovery feature of the AV, when the AV has an emergency recovery feature. (SSS139)[SSDD264]

Upon operator initiation the emergency recovery feature of the AV, the Common UAV Control CSCI shall verify that the AV received the emergency recovery instructions and is acting appropriately. (SSS139)[SSDD265]

When the AV fails to respond appropriately to the emergency recovery command within TBD seconds the Common UAV Control CSCI shall notify the operator within TBD milliseconds. (SSS139)[SSDD266]

The Common UAV Control CSCI shall provide sufficient cues to allow the operator to safely navigate the AV while inflight using instrumentation designed to meet Instrument Flight Rules (IFR). (SSS347)[SSDD267]

The Common UAV Control CSCI shall provide sufficient displays to allow the operator to operate each AV within its certified operational flight envelope. (SSS348)[SSDD268]

The Common UAV Control CSCI shall provide the capability for appropriate caution(s) to be provided to the operator when the air vehicle is approaching an unsafe flight regime. (SSS349)[SSDD269]

The Common UAV Control CSCI shall generate sufficient cautions and warnings to alert the operator if the air vehicle deviates into unsafe flight regime. (SSS349)[SSDD270]

The Common UAV Control CSCI shall generate sufficient cautions and warnings to alert the operator when the AV system has identified a malfunction. (SSS351)[SSDD271]

The Common UAV Control CSCI shall provide the required information to allow the operator to maintain safe separation from other aircraft and a safe altitude in civilian airspace per Federal Aviation Administration (FAA) rules. (SSS352)[SSDD272]

The Common UAV Control CSCI shall be designed such that no single software error results in the transmission of unsafe command(s) to the AV. (SSS556)[SSDD273]

The Common UAV Control CSCI shall provide the capability to implement an emergency action plan, if supported by the AV, to control the AV during equipment failures. (SSS539)[SSDD274]

Upon operator initiation of the emergency action plan of the AV, the Common UAV Control CSCI shall verify that the AV received the emergency action instructions and is acting appropriately. (SSS539)[SSDD275]

When the AV fails to respond appropriately to the emergency action plan within TBD seconds, the Common UAV Control CSCI shall notify the operator within TBD seconds. (SSS539)[SSDD276]

4.2.5.2.1.4 AV Flight Monitoring

The following TCS requirements are allocated to the AV Flight Monitoring element of the Common UAV Control CSCI:

- Generic and specific safety of flight processing
- AV caution/warning/alerts and operator response log
- Logging all information sent to an AV
- Logging all data received from an AV
- HCI requirements

While simultaneously flying two AVs of different types, the Common UAV Control CSCI shall monitor each AV at an alternating rate of TDB seconds to perform error analysis and issue warnings when necessary. (SSS108)[SSDD277]

The Common UAV Control CSCI shall have the capability to sequentially monitor multiple AVs. (SSS112)[SSDD278]

The Common UAV Control CSCI shall notify the operator when AV performance parameters are out of limits. (SSS113)[SSDD279]

The Common UAV Control CSCI shall provide the capability to monitor the status of all AV subsystems reporting status. (SSS142)[SSDD280]

The Common UAV Control CSCI shall display the AV status, to include but not be limited to the AV location and system status. (SSS143)[SSDD281]

While the datalink is not operational, the Common UAV Control CSCI shall present the last known AV status values and the time at which the last values were reported. (SSS144)[SSDD282]

The Common UAV Control CSCI shall be capable of displaying the fuel parameters to the operator to include as a minimum, fuel status, flow rate, and bingo fuel. (SSS145)[SSDD283]

The Common UAV Control CSCI shall provide sufficient cues to allow the operator to safely monitor the AV while inflight using instrumentation designed to meet IFR. (SSS347)[SSDD284]

4.2.5.2.1.5 Datalink Management and Control

The following TCS requirements are allocated to the System Status element of the Common UAV Control CSCI:

- Generic and specific datalink processing (TCS datalink terminal and air datalink terminal control and monitoring)
- Frequency management
- Datalink channel management
- AV ADT and GDT antenna control
- HCI requirements

The Common UAV Control CSCI shall provide the capability to control automatic switching to a SATCOM antenna, if the selected AV has SATCOM capability, when the AV proceeds beyond LOS range or when LOS is obstructed. (SSS117)[SSDD285]

The Common UAV Control CSCI shall provide the operator the capability to fully control the AV's Identification Friend or Foe (IFF). (SSS121)[SSDD286]

The Common UAV Control CSCI shall allow the operator to control an AV using the LOS or SATCOM datalinks. (SSS124)[SSDD287]

The Common UAV Control CSCI shall provide for air vehicle flight control beyond line of sight via uplink command for a minimum of two air vehicles of the same type using sequential communication techniques. (SSS125)[SSDD288] Sequential communication means alternatively communicating with one air vehicle and then the other. Current air vehicle design does not permit concurrent communications with two air vehicles at the same time.

The Common UAV Control CSCI shall provide the functionality to control, monitor, and display the operation of the ADT. (SSS132)[SSDD289] Control will include control of the ADT antenna (SSS133)[SSDD290] and of the ADT transmitter and receiver signal strength and frequencies used by ADT for data link communication. (SSS134)[SSDD291]

The Common UAV Control CSCI shall provide the ability for payload control beyond line of sight via uplink command of two air vehicles of the same type using a sequential communication technique. (SSS149)[SSDD292]

The Common UAV Control CSCI shall have the capability to control and monitor a LOS or SATCOM datalink terminal. (SSS158)[SSDD293]

The Common UAV Control CSCI control of the datalink terminal shall include, but not be limited to, antenna pointing control, transmitter control, and receiver control. (SSS160)[SSDD294]

The TCS shall provide the system functionality necessary to record data obtained via the datalink. (SSS527) [SSDD997]

For a previously selected datalink terminal, the Common UAV Control CSCI shall be capable of automatically selecting one of the following LOS Data Terminal Modes of operation (SSS162) [SSDD998]:

1. acquisition, (SSS161)[SSDD295]
2. autotrack, (SSS161)[SSDD296]
3. search, (SSS161)[SSDD297]
4. manual point, (SSS161)[SSDD298]
5. omni directional, (SSS161)[SSDD299] and
6. directional (SSS161)[SSDD300]

if applicable to the selected datalink.

The Common UAV Control CSCI shall provide the capability for operator to be able to manually override any automatic datalink terminal control mode selection. (SSS163)[SSDD301]

The Common UAV Control CSCI shall support a sequential LOS datalink and beyond LOS datalink capability. (SSS164)[SSDD302]

The Common UAV Control CSCI shall provide an interactive display for the purpose of control and monitoring of the datalink terminal. (SSS165)[SSDD303]

The Common UAV Control CSCI shall be capable of providing commands that direct the datalink terminal to automatically point the directional antenna(s). (SSS167)[SSDD304]

The Common UAV Control CSCI shall provide the operator the ability to manually point the directional antenna(s). (SSS168)[SSDD305]

The Common UAV Control CSCI shall be capable of properly selecting and positioning antennas to maintain LOS or SATCOM communication. (SSS170)[SSDD306]

The Common UAV Control CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver functions of the selected datalink terminal. (SSS171)[SSDD307]

The Common UAV Control CSCI shall provide the operator the ability to manually override the automatic function selection of the selected datalink terminal. (SSS172)[SSDD308]

The Common UAV Control CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver modes of the selected datalink terminal. (SSS173)[SSDD309]

The Common UAV Control CSCI shall provide the operator the ability to manually override the automatic mode selection of the selected datalink terminal. (SSS174)[SSDD310]

The Common UAV Control CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver frequencies of the selected datalink terminal. (SSS175)[SSDD311]

The Common UAV Control CSCI shall provide the operator the ability to manually select the transmitter and receiver frequency selections. (SSS176)[SSDD312]

The Common UAV Control CSCI shall receive, process, and present status data to the operator to monitor the status of the datalink terminal and the supported AV data link. (SSS177)[SSDD313]

The Common UAV Control CSCI shall be capable of monitoring and displaying the signal strength of the received and transmitted signals for the selected datalink terminal. (SSS178) [SSDD314]

The Common UAV Control CSCI shall be capable of monitoring and displaying the signal quality of the received and transmitted signals for the selected datalink terminal. (SSS179) [SSDD315]

The Common UAV Control CSCI shall be capable of presenting to the operator a visual depiction of the minimum and maximum data link operational ranges. (SSS180) [SSDD316]

The Common UAV Control CSCI shall support a concurrent uplink and downlink capability regarding the transmission of AV commands and reception of AV telemetry and status. (SSS325)[SSDD317]

The Common UAV Control CSCI shall support a concurrent uplink and downlink capability regarding the transmission of payload commands and reception of payload data and status. (SSS325)[SSDD318]

The Common UAV Control CSCI shall monitor the uplink and downlink to each AV under its control. (SSS355)[SSDD319]

Upon detection of loss of link, the Common UAV Control CSCI shall issue the proper commands to attempt to re-establish communications with the air vehicle. (SSS356)[SSDD320]

The Common UAV Control CSCI shall provide unambiguous AV control and status feedback indicators to ensure safe, efficient operations of two AVs by a single TCS. (SSS475)[SSDD321]

4.2.5.2.1.6 EO/IR Payload Control

The following TCS requirements are allocated to the EO/IR Payload Control element of the Common UAV Control CSCI:

- Generic and specific reconnaissance processing
- Dynamic inflight payload plan modifications
- HCI requirements

The Common UAV Control CSCI shall be interoperable with EO/IR Payloads. (SSS013)[SSDD322]

The Common UAV Control CSCI shall have the capability to control and monitor the EO/IR payload. (SSS147) [SSDD323]

The Common UAV Control CSCI shall have the capability to control payloads on an AV that is being controlled from another TCS. (SSS148) [SSDD324]

The Common UAV Control CSCI shall permit the operator to control the payload using the methods supported by the payload being controlled. (SSS152) [SSDD325]

Table 4.2.5.2.1.6-1 defines the payload control methods to be supported for the candidate AVs.

Table 4.2.5.2.1.6-1 Payload Control Methods

| PAYLOAD TYPE | CONTROL METHOD |
|---------------------|-----------------------|
| EO/IR | Point to Coordinate |
| | Hold on Coordinates |
| | Auto-Track |
| | Auto-Search |

The Common UAV Control CSCI shall respond appropriately to commands received from the operator to override payload automated or preprogrammed inputs. (SSS154) [SSDD326]

The Common UAV Control CSCI shall provide coarse and fine payload control capabilities directly on the payload screen. (SSS478) [SSDD327]

4.2.5.2.1.7 EO/IR Imagery Viewer

The following TCS requirements are allocated to the EO/IR Imagery Viewer element of the Common UAV Control CSCI:

- EO/IR image viewing
- Airborne VCR control processing
- TCS VCR and video support processing
- HCI requirements

The Common UAV Control CSCI shall have the functionality to process payload product data from Electro Optical (EO) and Infrared (IR) payloads. (SSS182) [SSDD328]

The Common UAV Control CSCI shall be able to store up to 24 hours of EO/IR payload imagery and associated telemetry data. (SSS184) [SSDD329]

The Common UAV Control CSCI shall have a built-in word processing and text capability including the ability to annotate textual information on imagery. (SSS187) [SSDD330]

The Common UAV Control CSCI shall be capable of receiving HAE UAV payload imagery. (SSS188) [SSDD331]

The Common UAV Control CSCI shall provide the functionality that allows the operator to correlate, format, and internally route the EO/IR video imagery. (SSS190) [SSDD332]

The Common UAV Control CSCI shall interface with the Video Support HWCI, VCR, and Printer

to provide the operator with the capability to record the video (SSS190) [SSDD333], capture and store a freeze frame of the video (SSS191) [SSDD334], retrieve and display the video (SSS192) [SSDD335], print out a hard copy of freeze frame imagery (SSS193) [SSDD336], and process digital imagery for export and dissemination. (SSS194) [SSDD337]

The Common UAV Control CSCI shall display live and recorded imagery data, with as well as without annotation and overlay, upon operator request. (SSS195) [SSDD338]

The Common UAV Control CSCI operator shall be able to select the content of the overlay information. (SSS196) [SSDD339]

The Common UAV Control CSCI shall have the capability to insert or remove cross hairs (or other similar Icons) to identify objects in the imagery viewer. (SSS197) [SSDD340]

Upon operator request, the Common UAV Control CSCI shall allow RS170A Video and digital imagery to be routed to the imagery viewer for display. (SSS198) [SSDD341]

The Common UAV Control CSCI shall interface with the Video Support HWCI to perform limited exploitation on the payload product data. (SSS200) [SSDD342] Limited exploitation, as a minimum, will include image enhancement, annotation, graphic overlay, and voice and textual reporting for spot and mission objectives.

The Common UAV Control CSCI image enhancement capabilities shall include contrast, brightness, edge enhancement, and sharpness. (SSS201) [SSDD343]

The Common UAV Control CSCI shall interface with the Video Support HWCI to provide the capability to capture frozen-frames of imagery. (SSS202) [SSDD344]

The Common UAV Control CSCI shall provide the commands to store the frozen-frames of imagery for further review and processing. (SSS202) [SSDD345]

The Common UAV Control CSCI shall have the capability to display NRT imagery with overlays to include, as a minimum, date/time group, target location coordinates when the target is in the center of the field of view, north seeking arrow, and AV position and heading. (SSS203) [SSDD346]

The Common UAV Control CSCI shall have the functionality to provide the following analog data processing capability:

1. Prepare both annotated and unannotated analog imagery for transmission (SSS237) [SSDD347]
2. Receive incoming annotated and unannotated analog imagery (SSS238) [SSDD348]
3. View incoming and outgoing, annotated and unannotated analog imagery (SSS243) [SSDD349]
4. View incoming and outgoing, annotated and unannotated digital imagery messages (SSS244) [SSDD350]

The Common UAV Control CSCI shall allow the operator to fully control the VCR via the Operator Output and Input HWCIs. (SSS334) [SSDD351]

The Common UAV Control CSCI shall provide unambiguous payload control and status feedback indicators to ensure safe, efficient operations of the payloads on two AVs. (SSS475) [SSDD352]

The Common UAV Control CSCI shall provide the capability to lock onto and hold a coordinate point in the imagery screen. (SSS481) [SSDD353]

The Common UAV Control CSCI shall provide for the capability to automatically overlay designated target locations from the payload screen onto the map screen. (SSS490) [SSDD354]

The Common UAV Control CSCI shall provide the capability to compute the range and bearing between two geographic positions located on the payload imagery display. (SSS560) [SSDD355]

4.2.5.2.1.8 EO/IR Imagery Data Acquisition

The following TCS requirements are allocated to the EO/IR Imagery Data Acquisition element of the Common UAV Control CSCI:

- EO/IR image (and telemetry) acquisition
- EOIR product manipulation and management processing (in conjunction with the DII imagery services)
- HCI requirements

The Common UAV Control CSCI shall have the capability to receive data from payloads on an AV that is being controlled from another TCS. (SSS148) [SSDD356]

The Common UAV Control CSCI shall receive, process, and present payload data to the operator so that the status of the payload can be determined. (SSS151) [SSDD357]

The Common UAV Control CSCI shall have the functionality to process payload product data to include correlating, formatting, storing, and internally routing payload information. (SSS182) [SSDD358]

The Common UAV Control CSCI shall provide the processing and control with the respective storage HWCI(s) to be able to store up to 24 hours of payload data. (SSS184) [SSDD359]

4.2.5.2.1.9 C4I Messages

The following TCS requirements are allocated to the C4I Messages element of the Common UAV Control CSCI:

- Generation of C4I data messages
- Dissemination to C4I users
- External data storage processing
- HCI requirements

The Common UAV Control CSCI shall make AV telemetry data available to support the development of C4I tactical communication messages. (SSS119) [SSDD360]

The Common UAV Control CSCI shall make Payload telemetry data available to support the development of C4I tactical communication messages. (SSS189) [SSDD361]

Common UAV Control CSCI shall be capable of receiving information flagging erroneous messages that cannot be corrected by the C4I Interfaces CSCI. (SSS235) [SSDD362]

For external communications to tactical C4I systems, the Common UAV Control CSCI shall utilize an Application Programming Interface (API) to deliver tactical data to the C4I Interface CSCI and the Tactical Communications (TACCOM) software modules. (SSS290) [SSDD363]

As a minimum, the tactical data developed by the Common UAV Control CSCI shall be presented to the TACCOM API in a format prescribed by and acceptable to the following Tactical Fire (TACFIRE) message:

1. Reconnaissance Exploitation Report (RECCEXREP) (SSS220)[SSDD364]
2. Size, Activity, Location, Unit, Time, and Equipment Report (SALUTE) (SSS220)[SSDD365]
3. Artillery Target Intelligence; Coordinate Report (ATI;CDR) (SSS220)[SSDD366]

The Common UAV Control CSCI shall have the functionality to provide the following data monitoring capability:

1. Display which C4I systems are supported and online during a mission (SSS240) [SSDD367]
2. Review all tactical communication messages received and transmitted (SSS242) [SSDD368]

The Common UAV Control CSCI shall coordinate the routing of VCR recorded payload video to the C4I Interfaces. (SSS335) [SSDD369]

4.2.5.2.1.10 NITF Files

The following TCS requirements are allocated to the NITF Files element of the Common UAV Control CSCI:

- Generation of C4I digital imagery and data messages
- Dissemination to C4I users
- External data storage processing
- HCI requirements

The Common UAV Control CSCI shall make AV telemetry data available to support the development of NITF 2.0 files. (SSS119) [SSDD370]

The Common UAV Control CSCI shall be in compliance with CIGSS, USIS, NITF 2.0, and GCCS when processing payload imagery data. (SSS185)[SSDD371]

The NITF 2.0 imagery files generated by Common UAV Control CSCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS186) [SSDD372]

The Common UAV Control CSCI shall be capable of receiving HAE UAV payload imagery in the form of NITF 2.0 files. (SSS188) [SSDD373]

The Common UAV Control CSCI shall make Payload telemetry data available to support the

development of NITF 2.0 files. (SSS189) [SSDD374]

4.2.5.2.1.11 Targeting

The following TCS requirements are allocated to the Targeting element of the Common UAV Control CSCI:

- Accurate target coordinate acquisition and development (Multiple Image Coordinate Extraction (MICE) and/or NIDAL software)
- Target location error analysis
- HCI requirements

The Common UAV Control CSCI shall make AV telemetry data available to support the development of accurate target coordinates. (SSS119) [SSDD375]

The Common UAV Control CSCI shall make Payload telemetry data available to support the development of accurate target coordinates. (SSS189) [SSDD376]

The Common UAV Control CSCI shall support a target location function where the operator can request the current ground location of the payload field-of-view center. (SSS206) [SSDD377]

The Common UAV Control CSCI shall have the functionality to determine the location of items of interest within the payload field of view, and express these locations in coordinates acceptable for military applications. (SSS207) [SSDD378]

The Common UAV Control CSCI shall have the functionality to develop an estimate of the error in computed target coordinates, and associate the error estimate with the appropriate target. (SSS208) [SSDD379]

4.2.5.2.1.12 Collection Tasking and Retasking

The following TCS requirements are allocated to the Collection Tasking and Retasking element of the Common UAV Control CSCI:

- Support tasking and retasking requests
- Log requests
- HCI requirements

The Common UAV Control CSCI shall permit the operator(s) to dynamically perform mission retasking during all phases of operational mission execution. (SSS067) [SSDD380]

The Common UAV Control CSCI shall make AV telemetry data available to support mission retasking efforts. (SSS119) [SSDD381]

The Common UAV Control CSCI shall make Payload telemetry data available to support mission retasking efforts. (SSS189) [SSDD382]

4.2.5.2.1.13 Launch and Recovery

The following TCS requirements are allocated to the Launch and Recovery element of the Common UAV Control CSCI:

- Generic and specific launch and recovery processing
- Support for automated launch and recovery system
- HCI requirements

The Common UAV Control CSCI shall support an automatic launch and recovery system. (SSS135) [SSDD383]

The Common UAV Control CSCI shall be interoperable with IBLIS (SSS136)[SSDD384], and UCARS. (SSS137) [SSDD385]

The Common UAV Control CSCI shall present sufficient cues to the operator to implement and monitor automatic launch and recovery, and to initiate abort procedures if required. (SSS138) [SSDD386]

The Common UAV Control CSCI shall provide sufficient cues to allow the operator to safely monitor AV take-off and landing using instrumentation designed to meet IFR. (SSS347) [SSDD387]

4.2.5.2.1.14 Training

The following TCS requirements are allocated to the Training element of the Common UAV Control CSCI:

- Provides for initial training on all TCS components as well as periodic re-certification
- Provides for computer based training
- Training evaluation processing
- HCI requirements

The Common UAV Control CSCI training capability shall be alterable without affecting the configuration of the operational software. (SSS402) [SSDD388]

The Common UAV Control CSCI shall provide a high resolution computer generated graphical user interface, that enables the UAV operator that is trained on one system to control different types of UAV as well as UAV payloads with minimal additional training. (SSS404) [SSDD389]

The Common UAV Control CSCI training capability shall provide, for the operator and maintainer, an embedded or add-on interactive training courseware with self-paced instruction, duplicating UAV flight performance characteristics, capabilities, and limitations. (SSS492) [SSDD390]

The Common UAV Control CSCI training capability shall be compatible with the U.S. Army Intelligence and Electronic Warfare Tactical Proficiency Trainer as an objective. (SSS493) [SSDD391]

The Common UAV Control CSCI training capability shall not support formal training operations concurrent with the execution of an actual mission. (SSS499) [SSDD392] The capability for the conduct of actual communications processing concurrently with training operations shall be provided if and only

if messages are identified as training messages. (SSS500) [SSDD393]

The Common UAV Control CSCI shall record operator and maintainer actions for self assessment and performance enhancement. (SSS502) [SSDD394]

The Common UAV Control CSCI shall record and make retrievable parameters that can be utilized to measure operator and maintainer performance. (SSS503) [SSDD395]

4.2.5.2.1.15 Maintenance

The following TCS requirements are allocated to the Maintenance element of the Common UAV Control CSCI:

- Periodic and extensive FD/L processing
- Maintenance processing
- Contribution to logistic databases
- Interactive electronic technical manuals
- Software debug and monitoring processing
- HCI requirements

The Common UAV Control CSCI shall perform periodic FD/L on the NRT Computer HWCIs while in the Normal Operations Mode and Training Mode. (SSS036) [SSDD396]

The Common UAV Control CSCI shall periodically provide FD/L status to TCS Main element of the Common UAV Control CSCI, while in the Normal Operations Mode and Training Mode, for purposes of determining the level of interaction maintainable by the available HWCIs. (SSS036) [SSDD397]

The Common UAV Control CSCI shall be capable of executing each of the AV specific maintenance software packages and displaying the appropriate results. (SSS245) [SSDD398]

The Common UAV Control CSCI shall be capable of executing each of the payload specific maintenance software packages and displaying the appropriate results. (SSS246) [SSDD399]

The Common UAV Control CSCI shall be capable of executing each of the datalink terminal specific maintenance software packages and displaying the appropriate results. (SSS247) [SSDD400]

The Common UAV Control CSCI shall be capable of executing NRT Computer and peripheral equipment maintenance software and displaying appropriate status results. (SSS248) [SSDD401]

The Common UAV Control CSCI shall provide processing capability to exercise FD/L periodically during Normal Operations and Training Modes, and extensively, if selected, as part of Maintenance Mode. (SSS250) [SSDD402]

The Common UAV Control CSCI shall provide the operator the ability to control and monitor the AV's FD/L. (SSS251) [SSDD403]

The Common UAV Control CSCI shall provide the operator the ability to control and monitor the Payload's FD/L. (SSS252) [SSDD404]

The Common UAV Control CSCI shall provide the operator the ability to control and monitor the Datalink FD/L. (SSS253) [SSDD405]

Periodic FD/L processing provided by the Common UAV Control CSCI shall fault detect TBD% of all mission critical failures with a false alarm rate not to exceed TBD%. (SSS260) [SSDD406]

Periodic FD/L processing provided by the Common UAV Control CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS261) [SSDD407]

The remaining mission critical failures detected but not isolated by Periodic FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the Common UAV Control CSCI. (SSS262) [SSDD408]

Likewise, periodic FD/L processing provided by the Common UAV Control CSCI shall fault detect TBD% of all non-mission critical failures with a false alarm rate not to exceed TBD%. (SSS263) [SSDD409] Periodic FD/L shall isolate TBD% of all detected non-mission critical failures to a single LRU. (SSS264) [SSDD410]

The remaining non-mission critical failures detected but not isolated by Periodic FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the Common UAV Control CSCI. (SSS265) [SSDD411]

Periodic FD/L processing provided by the Common UAV Control CSCI shall never take longer than TBD minutes to execute (SSS266) [SSDD412] and shall continuously operate in the background while the system is in the Operations state. (SSS267) [SSDD413]

Extensive FD/L processing provided by the Common UAV Control CSCI shall fault detect TBD% of all mission critical failures with a false alarm rate not to exceed TBD%. (SSS268) [SSDD414]

Extensive FD/L processing provided by the Common UAV Control CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS269) [SSDD415]

The remaining mission critical failures detected but not isolated by Extensive FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the Common UAV Control CSCI. (SSS270) [SSDD416]

Likewise, Extensive FD/L processing provided by the Common UAV Control CSCI shall fault detect TBD% of all non-mission critical failures with a false alarm rate not to exceed TBD%. (SSS271) [SSDD417]

Extensive FD/L processing provided by the Common UAV Control CSCI shall isolate TBD% of all detected non-mission critical failures to a single LRU. (SSS272) [SSDD418]

The remaining non-mission critical failures detected but not isolated by Extensive FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the Common UAV Control CSCI. (SSS273) [SSDD419]

Extensive FD/L processing provided by the Common UAV Control CSCI shall allow the operator(s) to select specific tests or all tests for execution. (SSS274) [SSDD420]

Extensive FD/L processing provided by the Common UAV Control CSCI shall inform the

operator(s) how long a specific test will take and periodically, at least once every TBD seconds, delineate the estimated time until completion. (SSS275) [SSDD421]

The Common UAV Control CSCI shall allow Authorized Operators to install software upgrades via CD-ROM or other media storage devices. (SSS276) [SSDD422] The Common UAV Control CSCI shall restrict Operator access to this capability via password protection. (SSS277) [SSDD423]

The Common UAV Control CSCI shall provide the capability for Authorized Operators to modify all TCS software programmable parameters. (SSS278) [SSDD424] As a minimum, The Common UAV Control CSCI shall restrict Operator access to this capability via password protection. (SSS279) [SSDD425]

The Common UAV Control CSCI shall allow an Authorized Operator to execute a software debug capability and view the resulting debug diagnostic information. (SSS282) [SSDD426] As a minimum, the Common UAV Control CSCI shall restrict Operator access to this capability via password protection. (SSS283)[SSDD427]

4.2.5.2.2 TCS Mission Planner CSCI

The TCS Mission Planner CSCI will consist of the following basic elements:

1. Route Planner
2. Payload Planner
3. Datalink Planner
4. Communications Planner
5. Plan Monitoring
6. Training
7. Maintenance

The TCS Mission Planner CSCI shall have the functionality to allow the operator to generate an AV mission plan. (SSS050) [SSDD428]

The TCS Mission Planner CSCI shall include all necessary information required to be interoperable with the service specific mission planning systems including the Tactical Automated Mission Planning System (TAMPS), Aviation Mission Planning System (AMPS), and Air Force Mission Support System (AFMSS). (SSS051) [SSDD429]

The TCS Mission Planner CSCI shall facilitate automated processing of mission plan data received via C4I interfaces in order to extract the appropriate mission planning data. (SSS052) [SSDD430]

The TCS Mission Planner CSCI shall have the functionality to receive and process AV mission plans from other TCSs. (SSS054) [SSDD431]

The TCS Mission Planner CSCI shall have the functionality to transmit AV mission plans over the TCS Low Speed LAN to other TCSs. (SSS056) [SSDD432]

The TCS Mission Planner CSCI shall include a Flight Route Plan for a selected AV, a Payload Plan for the selected payload, and a Communications Plan. (SSS057) [SSDD433]

The TCS Mission Planner CSCI shall be capable of managing the storage of a minimum of 500 mission plans under unique names to allow for later retrieval. (SSS058) [SSDD434]

The TCS Mission Planner CSCI shall provide the processing to support a graphical user interface via the Operator Output HWCI, that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059) [SSDD435]

The TCS Mission Planner CSCI shall have the capability to import as well as create and modify map display overlays for fire support coordination measures (SSS547) [SSDD436], airspace control measures (SSS548) [SSDD437], and threat identification measures. (SSS060) [SSDD438]

The TCS Mission Planner CSCI shall include a standard set of parameters to be entered by the operator such as service (i.e. Army, Navy, etc.), mission type (i.e. reconnaissance, rescue search, battle damage assessment, targeting, training, etc.), AV type (Outrider, Predator as a minimum), payload type (POP EO/IR, MOSP EO/IR, SAR, laser designator as a minimum), communication type(s) (C-band LOS, K-band satellite as a minimum), mission ID, and planned launch time. (SSS068) [SSDD439]

The TCS Mission Planner CSCI shall allow the operator to choose what parameters will be displayed in the continuous feedback window. (SSS068) [SSDD440]

The TCS Mission Planner CSCI shall allow the operator to upload a new mission plan before AV flight. (SSS070) [SSDD441]

The TCS Mission Planner CSCI shall allow the operator to create/retrieve/modify/save/delete mission plans, (SSS071)[SSDD442] and allow the operator to save the mission plans under a different name. (SSS072) [SSDD999]

The TCS Mission Planner CSCI shall allow the operator to perform a mission validity check at any time during mission planning and automatically prior to releasing the mission plan for upload to the AV. (SSS073) [SSDD443]

The TCS Mission Planner CSCI shall display the results of the validity check to the operator upon completion. (SSS074) [SSDD444]

The TCS Mission Planner CSCI validity check results shall indicate the problem area(s) of the mission plan if errors were found. (SSS074) [SSDD445]

The TCS Mission Planner CSCI shall notify the operator that the plan is valid if no errors were found during the validity check. (SSS074) [SSDD446]

Waypoints developed by the TCS Mission Planner CSCI shall consist of coordinates, time of arrival, commanded altitude, commanded airspeed, and any other applicable information (loiter time, loiter pattern/parameters, and VCR control as a minimum). (SSS079) [SSDD447]

The TCS Mission Planner CSCI shall allow the operator to perform flight route planning (SSS079) [SSDD448], payload planning (SSS103)[SSDD449], and communication planning (SSS105)[SSDD450] as an integrated process with a single plan entity or as separate processes whose products are to be combined prior to upload to the AV.

The TCS Mission Planner CSCI shall provide the capability to include up to 500 waypoints in each flight route plan. (SSS080) [SSDD451]

The TCS Mission Planner CSCI shall allow the operator to display overlay data consisting of the TCS location (SSS099) [SSDD452], other TCS(s) location(s) (SSS099) [SSDD453], GDT location (SSS099) [SSDD454], RVT(s) location(s) (SSS099) [SSDD455], air vehicle location (SSS096) [SSDD456], airborne relay location (SSS096) [SSDD457], payload center field of view location (SSS097) [SSDD458], payload footprint location (SSS097) [SSDD459], launch/recovery site(s) location(s) (SSS100) [SSDD460], and route plan waypoints (SSS101) [SSDD461] on the map as a minimum, when the coordinates are displayed on the map.

The TCS Mission Planner CSCI shall allow the operator to choose the coordinate system used for displays, data entry, and computations (UTM 84, MGRS 84, MGRS TD, MGRS NAD27, North American, WGS 72 and WGS 84 as a minimum). Note: WGS 84 is the name of a system, a datum, and an ellipsoid.(SSS102) [SSDD462]

The TCS Mission Planner CSCI shall provide the operator with the necessary tools for mission planning. (SSS397) [SSDD463]

The TCS Mission Planner CSCI shall provide automatically recording of all Mission Plan state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD464]

The TCS Mission Planner CSCI shall provide the capability to display (SSS552) [SSDD465] and print (SSS553) [SSDD1002] waypoint data in alphanumeric format.

4.2.5.2.2.1 Route Planner

The following TCS requirements are allocated to the Route Planner element of the TCS Mission Planner CSCI:

- All route planning requirements for the AV except for dynamic inflight modification
- Interoperable with service-specific mission planning systems
- HCI requirements

The TCS Mission Planner CSCI shall provide the capability to display overlays each containing 100 simultaneous icons of known threat systems (SSS061) [SSDD466], of known threat engagement envelopes with associated radar terrain masking of those threats (SSS062) [SSDD467], of known fire support coordination zones (SSS549) [SSDD468], and of known airspace control zones. (SSS550) [SSDD469]

The TCS Mission Planner CSCI shall have a de-clutter function (SSS063) [SSDD470] that allows the operator to designate only the threats of highest priority for display. (SSS064) [SSDD471]

The TCS Mission Planner CSCI shall use the signature vs. threats database generated by the AV manufacturer for each AV type to display an AV signature overlay (SSS065) [SSDD472] for each threat. (SSS066) [SSDD473]

The TCS Mission Planner CSCI shall store and retrieve AV performance/characteristic profiles for each type of AV. (SSS069) [SSDD474]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a terrain clearance check for the entire flight route corridor to ensure that the AV will maintain adequate altitude margin (to avoid surface impact) during the entire flight. (SSS073) [SSDD475]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a fuel consumption analysis for the entire flight route corridor (SSS073) [SSDD476] to ensure that the AV will have sufficient fuel to complete its mission and recovery. (SSS076) [SSDD477]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a threat exposure analysis for the entire flight route corridor to ensure that the AV will not be exposed to threats during any part of the mission. (SSS073) [SSDD478]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform an air traffic restriction analysis for the entire flight route corridor to ensure that the AV does not fly into flight restricted areas. (SSS073) [SSDD479]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform an AV performance envelope check, using a 6-DOF model and available weather data, for the entire flight route corridor (not just waypoints) (SSS073) [SSDD480] to ensure that the AV can achieve all flight objectives (SSS090) [SSDD481] (i.e. maximum rate of climb must be considered when an altitude change is desired; maximum airspeed must be considered when a specific time over target is desired; high winds may cause the AV to deviate from a desired loiter pattern; the AV may be unable to reach a desired destination on time due to head winds).

The minimum set of parameters available for display by the TCS Mission Planner CSCI in the continuous feedback window shall include fuel calculation results (total fuel used and remaining fuel at each waypoint), time calculation results (total time elapsed and time of day at each waypoint), distance calculation results (total route distance and distance between waypoints), areas below the minimum altitude margin, airspace violations, and exposure to threats. (SSS059)[SSDD482]

The TCS Mission Planner CSCI shall optimize a flight route plan, according to the optimization parameters chosen and prioritized by the operator, as the operator creates it (e.g. minimal fuel consumption, minimal threat exposure, etc.). (SSS076) [SSDD483]

The TCS Mission Planner CSCI shall display mission waypoints graphically. (SSS081) [SSDD484]

The TCS shall present to the operator the estimated time of arrival and fuel status at each programmed waypoint of the proposed mission plan. (SSS088) [SSDD1000]

The TCS Mission Planner CSCI shall display both projected and actual flight path, graphically. (SSS081) [SSDD485]

The TCS Mission Planner CSCI shall provide the capability to enter waypoint data graphically (SSS551) [SSDD1001] or in alphanumeric format. (SSS082) [SSDD486]

The TCS Mission Planner CSCI shall prevent the operator from creating a flight route plan that includes weight and balance conditions that would not be viable due to takeoff constraints. (SSS083) [SSDD487]

AV performance/characteristic profiles utilized by the TCS Mission Planner CSCI shall include AV

weight (SSS083) [SSDD488], fuel usage characteristics (SSS084) [SSDD489], fuel weight per unit (SSS084) [SSDD490], fuel tank capacity (SSS084) [SSDD491], valid payload types (SSS013) [SSDD492], maximum altitude, stall airspeed, maximum airspeed, maximum climb rate, maximum descent rate, and other data needed by the 6-DOF model.

For mission planning, the TCS Mission Planner CSCI shall provide terrain avoidance warning (SSS085) [SSDD493] and minimum reception altitude calculations for line of sight flights. (SSS350) [SSDD494]

The flight route plan developed by the TCS Mission Planner CSCI shall consist of a set of waypoints (SSS093) [SSDD495] and a flight path corridor (SSS087) [SSDD496] (the corridor is a region defined about the flight route which allows for deviations in the actual flight path due to GPS errors, wind, etc.).

The TCS Mission Planner CSCI shall generate a flight route plan to provide the necessary AV commands to autonomously execute a programmed flight and return to a designated recovery area. (SSS091) [SSDD497]

The TCS Mission Planner CSCI shall compute the estimated position of the AV during Loss of Link (LOL) based upon the last known AV position projected along the flight planned route. (SSS146) [SSDD498]

The TCS Mission Planner CSCI shall provide the capability to display operator definable “Lock Out” zones around waypoints, Launch and Recovery Points (LRPs), or any selected point on the AV flight path. (SSS482) [SSDD499]

4.2.5.2.2.2 Payload Planner

The following TCS requirements are allocated to the Payload Planner element of the Mission Planner CSCI:

- All payload planning requirements for an EO/IR payload except for dynamic inflight modification
- Interoperable with service-specific mission planning systems
- HCI requirements

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a payload restriction analysis for the entire flight route corridor (not just at waypoints) to ensure that the payload does not point/activate in payload restricted areas. (SSS073) [SSDD500]

The TCS Mission Planner CSCI shall analyze the payload plan to ensure that payload limitations will not prevent the payload from achieving all mission objectives (cannot view targets effectively at a certain altitude, cannot view targets effectively from a certain horizontal distance/angle, cannot view target area from behind a mountain, cannot view target effectively due to solar or lunar shadowing, cannot view target effectively due to environmental conditions, cannot obtain best thermal imagery due to light/heat transition periods as a minimum).(SSS086) [SSDD501]

The TCS Mission Planner CSCI shall generate a payload plan to provide the necessary payload commands to autonomously execute a programmed payload plan. (SSS091)[SSDD502]

Upon operator command, the TCS Mission Planner CSCI shall display (or remove from display) the search footprint and present center field of view of the payload to indicate the predicted payload FOV swath covered during the mission. (SSS097) [SSDD503]

Upon operator command, the TCS Mission Planner CSCI shall display (or remove from display) target icons indicating the location and types of targets. (SSS098) [SSDD504]

The TCS Mission Planner CSCI shall maintain the payload performance/characteristic profiles which include commands/modes for each payload type (on/off command, pointing commands, zoom/field-of-view commands, tracking commands, focus commands, stow/deploy commands, day/night modes as a minimum). (SSS104) [SSDD505]

When the footprint coordinates are displayed on the map, the TCS Mission Planner CSCI shall display the search footprint of the payload on the map. (SSS157) [SSDD506]

The TCS Mission Planner CSCI shall display the SAR imaging swath on the map display. (SSS479) [SSDD507]

The TCS Mission Planner CSCI shall provide the on-screen capability to select and efficiently move or reorient a previously defined SAR imaging swath. (SSS480) [SSDD508]

The TCS Mission Planner CSCI shall provide the capability to display the payload swath for planning purposes. (SSS541) [SSDD509]

4.2.5.2.2.3 Datalink Planner

The following TCS requirements are allocated to the Datalink Planner element of the TCS Mission Planner CSCI:

- All datalink planning requirements except for dynamic inflight modification
- Interoperable with service-specific mission planning systems
- HCI requirements

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a datalink coverage check for the entire flight route corridor to ensure that the AV will not lose link during any part of the mission. (SSS073) [SSDD510]

The TCS Mission Planner CSCI shall allow the operator to set the LOL delay timer(s) during mission planning. (SSS075) [SSDD511] The LOL delay is the time from when the AV detects an unplanned LOL to the time it initiates LOL procedures.

Prior to validating a mission plan, the TCS Mission Planner CSCI shall determine that the flight constraints of the AV and the limitations of the datalink are not violated. (SSS089) [SSDD512]

The TCS Mission Planner CSCI shall provide altitude calculations for minimum reception for line of sight flights. (SSS350) [SSDD513]

The TCS Mission Planner CSCI shall display a LOL timer to the operator initiating an LOL onset. (SSS536) [SSDD514]

The TCS Mission Planner CSCI shall compute and graphically display LOS versus terrain profile

(DTED). (SSS538) [SSDD515]

The TCS Mission Planner CSCI shall include the ability to perform minimum datalink reception altitude calculations for LOS flights. (SSS554) [SSDD516]

4.2.5.2.2.4 Communications Planner

The following TCS requirements are allocated to the Communications Planner element of the TCS Mission Planner CSCI:

- All communication planning requirements except for dynamic inflight modification
- Automatic monitoring of communication links while performing prescribed plan
- Interoperable with service-specific mission planning systems
- HCI requirements

The TCS Mission Planner CSCI shall have the capability to generate a Communications Plan as part of the Mission Plan. (SSS105) [SSDD517]

The TCS Mission Planner CSCI shall be able to receive a communications plan as part of a Mission Plan from a service specific mission planning system. (SSS106) [SSDD518]

The TCS Mission Planner CSCI shall be able to receive a communications plan as part of a Mission Plan from another TCS. (SSS106) [SSDD519]

The TCS Mission Planner CSCI's Communications Plan shall include the information which defines the C4I connectivity, as well as the RF Coordination Plan. (SSS107) [SSDD520]

4.2.5.2.2.5 Plan Monitoring

The following TCS requirements are allocated to the Plan Monitoring element of the TCS Mission Planner CSCI:

- Automatic monitoring of AV while flying mission plan, to include AV's capability to complete mission plan
- Automatic monitoring of payload while performing prescribed plan
- Automatic monitoring of datalink while performing prescribed plan
- Automatic monitoring of communication links while performing prescribed plan
- HCI requirements

The TCS Mission Planner CSCI shall provide the capability to monitor AV adherence to the uplinked mission plan, detecting any deviations greater than 10%, and notifying the operator within TBD seconds via the Operator Output HWCI when deviations are detected. (SSS141) [SSDD521]

The TCS Mission Planner CSCI shall provide the capability to monitor payload adherence to the uplinked mission plan. (SSS155) [SSDD522]

When the TCS Mission Planner CSCI determines the payload is not adhering to the uplinked mission plan (SSS141) [SSDD523] the operator shall be notified within TBD milliseconds. (SSS155) [SSDD524]

4.2.5.2.3 DII/COE CSCI

The DII/COE CSCI is a Government assembled Common Operating Environment. The DII/COE CSCI provides information management services of all kinds from Mapping, Charting, Geodesy, and Imagery Services to Message Processing Services to Printer Control Services. The DII Imagery Services provide services ranging from Image Exploitation Services (IESs) to NITF file generation.

The DII/COE CSCI shall provide the graphics and mapping capability required to perform flight route planning. (SSS092) [SSDD525]

The DII/COE CSCI shall provide the capability to display (or remove from display) a map. (SSS095) [SSDD526]

The DII/COE CSCI shall provide the capability to scroll the map display left, right, up, and down as desired. (SSS095) [SSDD527]

The DII/COE CSCI shall provide the capability to scroll the map such that a specified set of coordinates is at the center of the map display. (SSS095) [SSDD528]

The DII/COE CSCI shall provide the capability to commence automatic scrolling of the map (SSS095) [SSDD529] such that the AV position remains displayed on the map. (SSS096) [SSDD530]

The DII/COE CSCI shall provide the capability to cause the display to zoom in and zoom out as desired. (SSS095) [SSDD531]

The DII/COE CSCI shall provide the capability to commence automatic scrolling of the map such that the payload field of view remains displayed on the map. (SSS097) [SSDD532]

The DII/COE CSCI shall provide the capability to import National Imagery Mapping Agency (NIMA) Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), Arc Digitized Raster Graphic (ADRG) and scanned hard copy maps, via compact disk. (SSS280) [SSDD533]

The DII/COE CSCI shall provide the capability to import map information via operator procedure (SSS555) [SSDD534] and shall provide the capability of incorporating vector format and Compressed ADRG (CADRG) maps. (SSS281) [SSDD535]

The DII/COE CSCI shall provide the processing capability to coordinate the printing of freeze-frame video, C4I Messages, Mission Plans, FD/L information, and current map displays. (SSS315) [SSDD536]

The DII/COE CSCI shall provide the processing capability to output digital message data and imagery to a hard copy printer. (SSS316) [SSDD537]

The DII/COE CSCI shall provide the capability to receive and process digital data and digital imagery transferred from external storage systems. (SSS318) [SSDD538]

The DII/COE CSCI shall provide the capability to send and receive data from all the TCS data storage devices. (SSS339) [SSDD539]

The DII/COE CSCI shall provide the capability to transfer digital data or digital imagery to and from external data storage devices. (SSS340) [SSDD540]

The DII/COE CSCI shall provide the operator with a clearly indicated map scale. (SSS535) [SSDD541]

The DII/COE CSCI shall provide the capability to compute the range and bearing between two geographic positions located on the map display. (SSS561) [SSDD542]

The DII/COE shall support C4I Interfaces in providing the communication interface to the C4I Support Equipment, to allow the TCS Operator(s) to exchange messages with the Mobile Subscriber Equipment (MSE) and Single Channel Ground and Airborne Radio System (SINCGARS). (SSS285) [SSDD543]

4.2.5.2.4 C4I Interfaces CSCI

The following TCS requirements are allocated to this Configuration Item:

- All C4I software requirements
- HCI requirements

The C4I Interfaces CSCI shall have the functionality to receive AV mission plans from service specific mission planning systems. (SSS053) [SSDD544]

The C4I Interfaces CSCI shall notify TCS Mission Planner when a AV mission plan was received from service specific mission planning systems and the corresponding file name. (SSS053) [SSDD545]

The C4I Interfaces CSCI shall have the functionality to transmit AV mission plans to service specific mission planning systems. (SSS055) [SSDD546]

The C4I Interfaces CSCI shall be capable of entering DII/COE compliant (C4I) networks. Network interoperability will include, but not be limited to:

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)
3. Army Deep Operations Coordination System (ADOCS)
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)
11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)
15. Service Mission Planners

16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS) (SSS209) [SSDD547]

The C4I Interfaces CSCI shall have the functionality necessary to manage all aspects of C4I system interfaces to include receiving, processing, and transmitting tactical information to include but not limited to character based text messages, NITF 2.0 imagery files, RS-170A video and MPEG-2 video. (SSS210) [SSDD548]

The C4I Interfaces CSCI shall provide the functionality necessary to interface with various C4I systems in order to satisfy the operational requirements for:

1. Tasking TCS to plan and conduct a mission (SSS211) [SSDD549]
2. Presentation of payload product and target coordinates for export and dissemination (SSS211) [SSDD550]
3. Use of UAV obtained data (non-real time tracks, tactical points and amplifying information) to provide a C4I system with information that may be used by C4I system operators, for transmission on tactical data communication links, and available to support engagement by appropriate weapons systems (SSS211) [SSDD551]

The C4I Interfaces CSCI shall have the capability to interoperate with a server to receive, extract, and send intelligence data. (SSS212) [SSDD552]

The C4I Interfaces CSCI shall have the capability to use cable to deliver live video imagery to multiple locations. (SSS213) [SSDD553]

The C4I Interfaces CSCI shall have the ability to interface with service specific ground and airborne Ultra High Frequency (UHF), Very High Frequency (VHF), UHF/VHF, and High Frequency (HF) radios for digital message transmission while using the same radios for record traffic. (SSS214) [SSDD554]

Where applicable, the C4I Interfaces CSCI data burst messages shall comply with Variable Message Formats. (SSS215) [SSDD555]

The C4I Interfaces CSCI shall export and disseminate digital imagery. (SSS218) [SSDD556]

The C4I Interfaces CSCI shall export and disseminate RS-170A video (with or without overlay). (SSS219) [SSDD557]

The C4I Interfaces CSCI shall export and disseminate tactical communication messages. (SSS220) [SSDD558]

The C4I Interfaces CSCI shall have the functionality to provide the following control capabilities:

1. Send and receive tactical communication messages (SSS222) [SSDD559]

2. Send and receive annotated and unannotated digital imagery (SSS223) [SSDD560]
3. Establish and terminate digital communication with C4I systems (SSS224) [SSDD561]
4. Establish and terminate digital communication to peripheral devices (SSS225) [SSDD562]
5. Send and receive analog imagery in RS-170A format with or without overlay (SSS226) [SSDD563]
6. Establish and terminate analog communication to C4I systems (SSS227) [SSDD564]
7. Establish and terminate analog communication to peripheral devices (SSS228) [SSDD565]

The C4I Interfaces CSCI shall have the functionality to provide the following digital data processing capability:

1. Create Tactical Communications Messages to include United States Message Text Format (USMTF), Tactical Fire (TACFIRE), Over The Horizon Gold (OTH-Gold), and Intelligence and Electronic Warfare Character Oriented Message Catalog (IEWCOMCAT) For Transmission (specific message types will be identified in the TCS to C4I IDD) (SSS230) [SSDD566]
2. Review for completeness incoming Tactical Communication Messages (SSS231)[SSDD567]
3. Transmit annotated and unannotated digital imagery (SSS232) [SSDD568]
4. Review for completeness incoming annotated and unannotated digital imagery (SSS233) [SSDD569]

All digital messages received by the C4I Interfaces CSCI shall be automatically checked for errors. (SSS234) [SSDD570]

All erroneous messages shall be flagged to the Common UAV Control CSCI. (SSS235) [SSDD571]

The C4I Interfaces CSCI shall provide the capability to log all incoming and outgoing formatted tactical messages. (SSS236) [SSDD572]

The C4I Interfaces CSCI shall have the functionality to monitor the status of all C4I interfaces and pass this information on to the Common UAV Control CSCI. (SSS239) [SSDD573]

The C4I Interfaces CSCI shall have the functionality to provide the following data monitoring capability: monitor the status of all incoming and outgoing tactical communication messages (SSS241) [SSDD574]

The C4I Interfaces CSCI shall provide the capability to interface with equipment necessary to provide connectivity with standard DoD tactical (VHF, UHF, and UHF/VHF) radios, Mobile Subscriber Equipment, and military and commercial satellite communications equipment. (SSS285) [SSDD575]

The C4I Interfaces CSCI shall interface with external mission tasking systems (e.g., receive tasking

orders, coordinate mission certification). (SSS286) [SSDD576]

For external communications to C4I systems, the C4I Interfaces CSCI shall utilize Tactical Communications (TACCOM) which will consist of a set of software modules accessed through an Application Programming Interface (API). (SSS290)[SSDD577]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ASAS IAW TCS 201 TCS to All Source Analysis System Interface Design Description. (SSS291) [SSDD578]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JSTARS GSM IAW TCS 209 TCS to Joint Surveillance Target Attack Radar System Interface Design Description. (SSS292) [SSDD579]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JMCIS IAW TCS 214 TCS to Joint Maritime Command Information System Interface Design Description. (SSS293) [SSDD580]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JSIPS IAW TCS 210 TCS to Joint Service Imagery Processing System – Navy Interface Design Description and TCS 211 TCS to Joint Service Imagery Processing System – Air Force Interface Design Description. (SSS294) [SSDD581]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with AFATDS IAW TCS 200 TCS to Advanced Field Artillery Tactical Data System Interface Design Description. (SSS295) [SSDD582]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ADOCS Version TBD. (SSS296) [SSDD583]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with CARS IAW TCS 217 TCS to Contingency Airborne Reconnaissance System Interface Design Description. (SSS297) [SSDD584]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with CCTV IAW TCS 205 TCS to Closed Circuit Television Interface Design Description. (SSS298) [SSDD585]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with Service Mission Planners IAW TCS 219 TCS to Tactical Aircraft Mission Planning System Interface Design Description and TCS 220 TCS to Air Force Mission Support System Interface Design Description. (SSS299) [SSDD586]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with GCS/ACS IAW TCS 215 TCS to Guardrail Common Sensor/Aerial Common Sensor Interface Design Description. (SSS300) [SSDD587]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JDISS IAW TCS 212 TCS to Joint Deployable Intelligence Support System Interface Design Description. (SSS301) [SSDD588]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with TES IAW TCS 236 TCS to Tactical Exploration System Interface Design Description. (SSS302) [SSDD589]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow the TCS to communicate with IAS IAW TCS 206 TCS to Intelligence Analysis System Interface Design Description. (SSS303) [SSDD590]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ATHS IAW TCS 208 TCS to Automated Target Hand-off System Interface Design Description. (SSS304) [SSDD591]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ATWCS IAW TCS 203 TCS to Advanced Tactical Weapons Control System Interface Design Description. (SSS305) [SSDD592]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with Trojan Spirit II IAW TCS 213 TCS to Trojan Spirit II Interface Design Description. (SSS306) [SSDD593]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with TBMCS IAW TCS 221 TCS to Theater Battle Management Core System Interface Design Description. (SSS307) [SSDD594]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with MIES IAW TCS 216 TCS to Modernized Imagery Exploitation System Interface Design Description. (SSS308) [SSDD595]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ETRAC IAW TCS 218 TCS to Enhanced Tactical Radar Correlator Interface Design Description. (SSS309) [SSDD596]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with COMPASS ICW TCS 222 TCS to Common Operational Modeling, Planning, and Simulation System Interface Design Description. (SSS310) [SSDD597]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JSIPS TEG IAW TCS 207 TCS to Tactical Exploitation Group Interface Design Description. (SSS311) [SSDD598]

To achieve interoperability the C4I Interfaces CSCI shall provide a consistent and common set of interfaces for the United States Message Text Format (USMTF), Army Tactical Command Control System (ATCCS), and Field Artillery Tactical Data System (FATDS). (SSS406) [SSDD599]

The C4I Interface CSCI shall provide external interface control and configuration for the C4I communications media as shown in table 4.2.5.2.5-1. (SSS407) [SSDD600]

Table 4.2.5.2.5-1 C4I Communication Media's

| Communication Media |
|----------------------------|
| RS-232 |
| RS-422 |
| RS-170A |
| Wire line, 2-wire |
| Wire line, 4-wire |
| MSE (DNVT, DSVT) |
| MSE TPN |
| SINCGARS |
| ANG/GYC-7 |
| IEEE 802.3/LAN |

The C4I Interfaces CSCI shall provide API's for the transmission of imagery in National Imagery Transmission Formats (NITF) 1.0a and 2.0 as per MIL-STD-2500 and to be compatible with the Common Imagery Ground/Surface Station (CGIS) Guidelines. (SSS408) [SSDD601]

The C4I Interfaces CSCI shall provide automatic recording of all C4I Interfaces state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD602]

4.2.5.2.5 FD/L & Diagnostics CSCI

TBD.

4.2.5.2.6 AV Diagnostics CSCI

TBD.

4.2.5.2.7 TCS Data Server CSCI

The TCS Data Server CSCI will reside on the non-real time computer for levels 1, 2, & 3 of TCS interaction. Refer to section 4.2.3.2.2 for detailed information about the TCS Data Server.

4.2.6 Communications Subsystem

The Communications Subsystem consists of the HWCIs and CSCIs necessary for external communication including voice and data.

4.2.6.1 Communications Subsystem Hardware Configuration Items

The Communications Subsystem will consist of the following HWCIs: External Storage, Printer, Intercom Equipment, C4I Support Equipment, and Communications Equipment.

4.2.6.1.1 External Storage HWCI

The purpose of the External Storage HWCI is to provide additional storage space to be available to the NRT Computer HWCI. The External Storage HWCI will provide the ability to store and retrieve files to include as a minimum: mission plans, flight route plans, communication plans, maps, C4I messages, digital image, NITF 2.0, activities and process log, and training.

The TCS shall provide external data storage devices. (SSS317) [SSDD603] These external storage devices may include a CD Drive, a Tape Drive, and/or a RAID.

The external data storage devices shall be able to store and retrieve digital data or digital imagery to and from the TCS. (SSS318) [SSDD604]

The external data storage devices shall be capable of providing a 50% spare storage capacity over delivered storage used. (SSS317)[SSDD605] As an objective, a 75% storage capacity over used shall be provided. (SSS317)[SSDD606] The external data storage devices shall be expandable to include additional storage without major hardware reconfiguration. (SSS317)[SSDD607]

The purpose of the External Storage HWCI is to provide storage of digital data and digital imagery that can be retrieved later for processing. This enables internal storage to be free to receive and process priority data.

The TCS External Storage HWCI shall be expandable to include additional storage without major hardware reconfiguration. (SSS317)[SSDD608]

The TCS External Storage HWCI shall allow for data storage expansion such as external storage media devices like tape, disk and CD drives. (SSS376)[SSDD609]

The External Storage HWCI shall send Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD610]

The maximum size, weight, and power requirements for the External Storage HWCI shall not exceed the values shown in Table 4.2.6.1.1-1. (SSS374)[SSDD611]

Table 4.2.6.1.1-1 External Storage HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.6.1.2 Printer HWCI

The purpose of the TCS Printer HWCI is to provide the TCS with the capability to print hard copies.

The TCS Printer HWCI shall provide an internal hard copy printer to print digital imagery, C4I Messages, Mission Plans, and FD/L information. (SSS338)[SSDD612]

The TCS Printer HWCI shall send Common UAV Control CSCI the results of its periodic FD/L. (SSS036)[SSDD613]

The maximum size, weight, and power requirements for the Printer HWCI shall not exceed the values shown in Table 4.2.6.1.2-1. (SSS374) [SSDD614]

Table 4.2.6.1.2-1 Printer HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.6.1.3 Intercom Equipment HWCI

The TCS shall incorporate an Intercom Equipment HWCI that provides verbal communications in the situation where there are multiple operators. (SSS331)[SSDD615]

The Intercom Equipment HWCI shall be compatible with service specific voice communication systems. (SSS332)[SSDD616]

Figure 4.2.6.1.3-1 shows the individual components and interconnectivity of the Intercom HWCI.

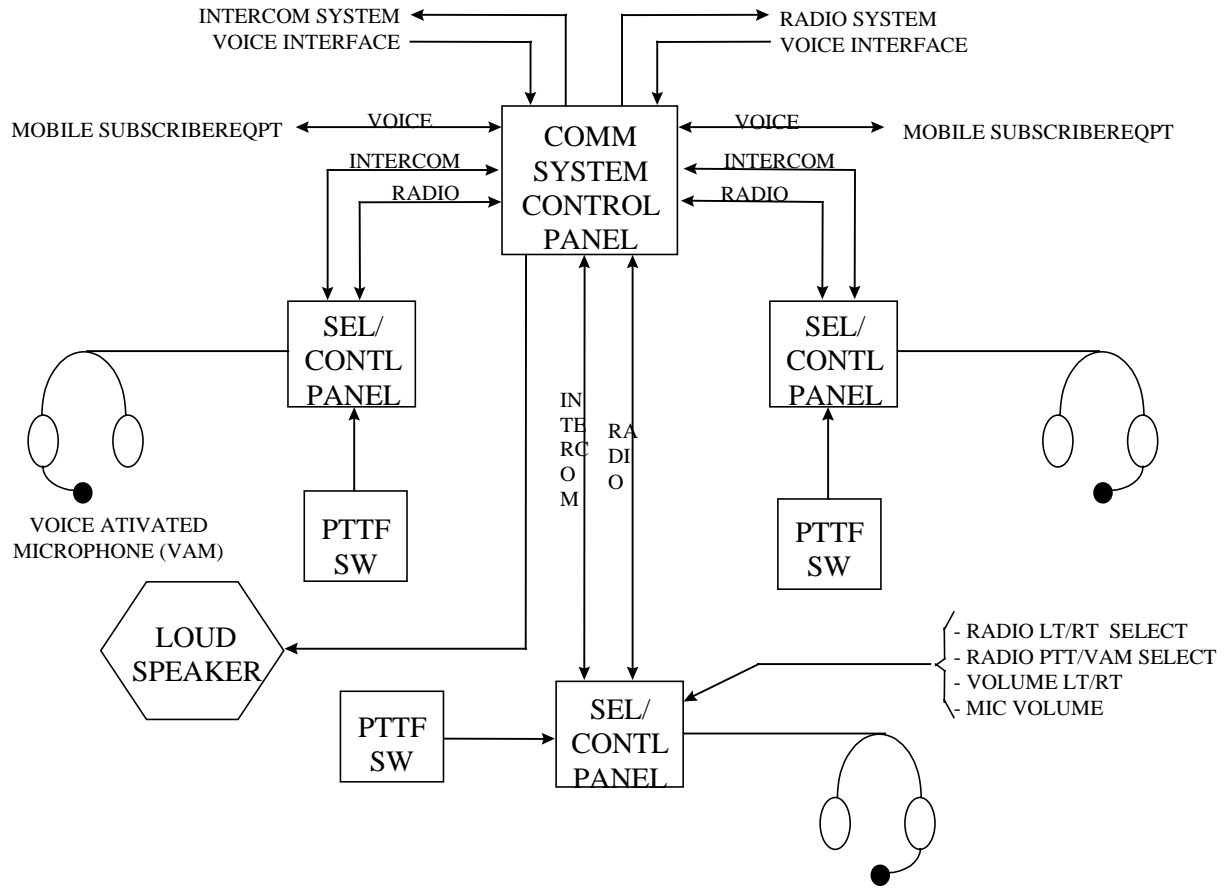


Figure 4.2.6.1.3-1 Intercom HWCI Interconnectivity Diagram

The maximum size, weight, and power requirements for the Intercom Equipment HWCI shall not exceed the values shown in Table 4.2.6.1.3-1. (SSS374)[SSDD617]

Table 4.2.6.1.3-1 Intercom Equipment HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.6.1.4 C4I Support Equipment HWCI

The C4I Support Equipment shall send Common UAV Control the results of its periodic FD/L. (SSS036)[SSDD618]

The C4I Support Equipment shall provide the capability to interface with military and commercial satellite communications equipment. (SSS285)[SSDD619]

The maximum size, weight, and power requirements for the C4I Support Equipment HWCI shall not exceed the values shown in Table 4.2.6.1.4-1. (SSS374)[SSDD620]

Table 4.2.6.1.4-1 C4I Support Equipment HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.6.1.5 Communications Equipment HWCI

The TCS shall provide communications with other military units via the Mobile Subscriber Equipment (MSE) and Single Channel Ground/Airborne Radio System (SINCGARS) interfaces to transmit/receive messages and image data.

The Tactical Communication equipment utilized with the TCS shall be comprised of currently developed or fielded (standard) communication equipment (telephones and radios) that is used in association with the TCS for communication. (SSS285)[SSDD621]

TCS and Tactical Communication Link interface shall provide data communication provision for Mobile Subscriber Equipment (MSE) and SINCGARS (i.e., 1 MSE channel and 1 SINCGARS channel). (SSS285)[SSDD622]

The TCS shall provide the capability to interface with a MSE TSEC/KY-68 telephone terminal to provide the capability for secure voice and data communications via telephone. (SSS285)[SSDD623]

The TCS shall provide the capability to interface with a SINCGARS AN/VRC-91A to provide the capability for secure data communications. (SSS285)[SSDD624]

The TCS Communication Equipment shall allow for long range communication from one TCS to another via Wide Area Network (WAN), interoperable C4I systems, and UAV data relay. (SSS375)[SSDD625]

There is no core communication equipment. See Appendices A and B for the respective TCS-LS and TCS-SB specific equipment.

The maximum size, weight, and power requirements for the Communications Equipment HWCI shall not exceed the values shown in Table 4.2.6.1.5-1. (SSS374)[SSDD626]

Table 4.2.6.1.5-1 Communications Equipment HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.6.2 Communications Subsystem Computer Software Configuration Items

No CSCIs currently exist for the Communications Subsystem.

4.2.7 Power Distribution Subsystem

The Power Distribution Subsystem consists of the HWCIs and CSCIs necessary for the TCS power requirements.

4.2.7.1 Power Distribution Subsystem Hardware Configuration Items

The Power Distribution Subsystem will consist of the following HWCIs: Uninterruptible Power Supply HWCI and Power Distribution HWCI.

4.2.7.1.1 Uninterruptible Power Supply HWCIs

The Uninterruptible Power Supply HWCI consists of the following HWCIs: Operator Station UPS HWCI and Support Equipment UPS HWCI.

4.2.7.1.1.1 Operator Station UPS HWCI

The Operator Station UPS HWCI is dependent upon type of computer. Refer to appendices for information.

The maximum size, weight, and power requirements for the Operator Station UPS HWCI shall not exceed the values shown in Table 4.2.7.1.1.1-1. (SSS374) [SSDD627]

Table 4.2.7.1.1.1-1 Operator Station UPS HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|--------------|------------|----------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.7.1.1.2 Support Equipment UPS

The TCS shall be capable of restoring power in sufficient time to avoid loss of air vehicle control during power outages. (SSS354)[SSDD628]

The TCS Uninterruptible Power Supply HWCI shall provide an uninterruptible power supply for critical phases of mission execution, landing and takeoff as a minimum design requirement. (SSS388) [SSDD629]

The TCS Uninterruptible Power Supply HWCI shall provide TBD minutes/hours to systematically and safely perform mission critical functions without loss of data or air vehicle control. (SSS388)[SSDD630]

The TCS Uninterruptible Power Supply HWCI shall provide electrical/electronic equipment protection to prevent power surge/power failure damage. (SSS388) [SSDD631]

The Uninterruptible Power Supply HWCI shall provide backup capability such that upon loss of the primary power supply, the TCS shall be capable of restoring and maintaining electrical backup power to avoid critical mission data loss, computer memory loss, or loss of AV control. (SSS387) [SSDD632]

The TCS Uninterruptible Power Supply HWCI shall send the Common UAV Control CSCI the results of its periodic FD/L. (SSS036) [SSDD633]

The maximum size, weight, and power requirements for the Support Equipment UPS HWCI shall not exceed the values shown in Table 4.2.7.1.1.2-1. (SSS374)[SSDD634]

Table 4.2.7.1.1.2-1 Support Equipment UPS HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.7.1.2 Power Distribution HWCI

The purpose of the Power Distribution HWCI is to condition and provide the necessary power to the various components of the TCS. Figure 4.2.7.1.2-1 shows the main components and their interconnectivity.

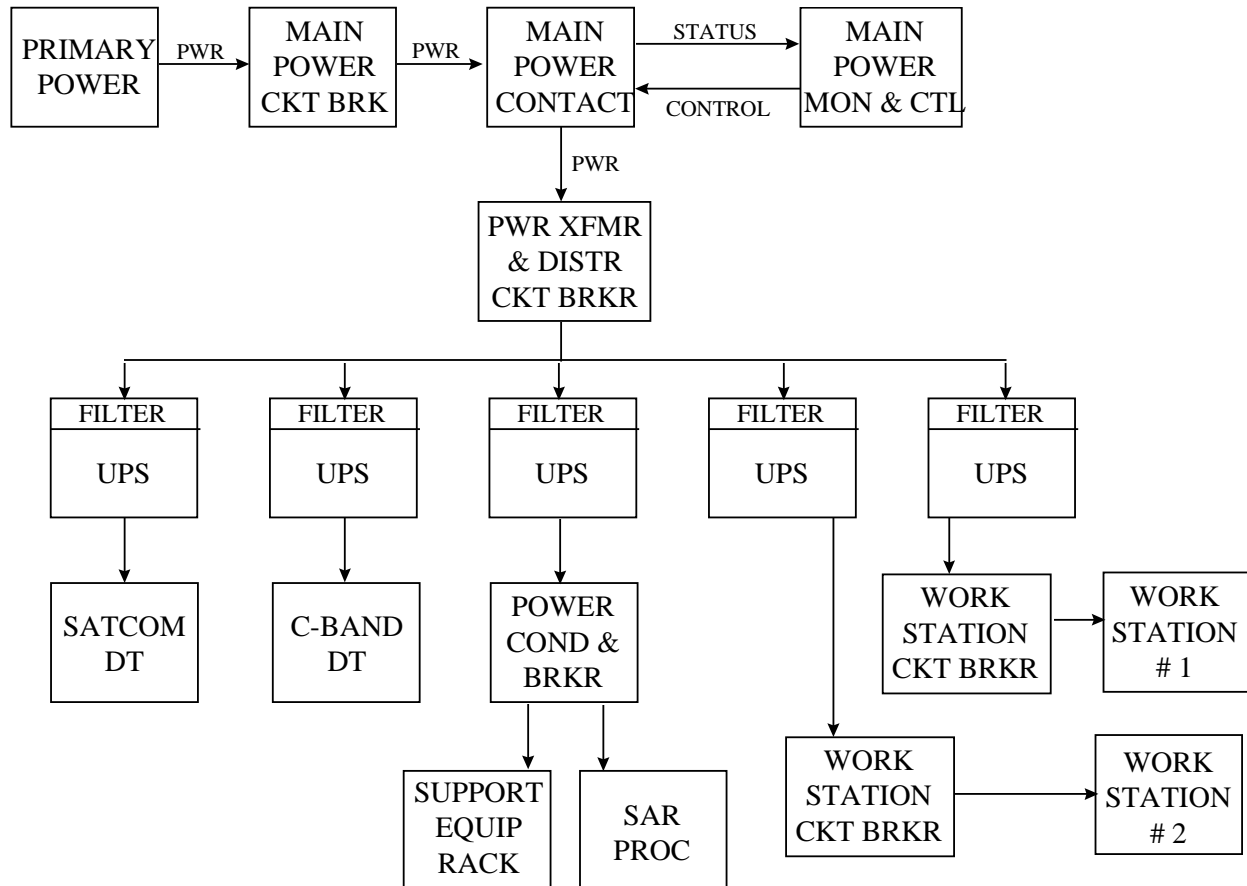


Figure 4.2.7.1.2-1 Power Distribution HWCI Interconnectivity Diagram

The TCS Power Distribution HWCI shall use standard military worldwide 110/220 volts 50/60 hertz generators and commercial power sources. (SSS385) [SSDD635]

The TCS HWCI shall use standard electrical power sources available within the DoD family of ground mobile, airborne, and shipboard electrical power sources, dependent on installation platform. (SSS386) [SSDD636]

The maximum size, weight, and power requirements for the Power Distribution HWCI shall not exceed the values shown in Table 4.2.7.1.2-1. (SSS374)[SSDD637]

Table 4.2.7.1.2-1 Power Distribution HWCI Maximum Size, Weight, and Power Requirements

| Requirements | Dimensions | Comments |
|---------------------|-------------------|-----------------|
| Size | TBD | |
| Weight | TBD | |
| Power | TBD | |

4.2.7.2 Power Distribution Subsystem Computer Software Configuration Items

The Power Distribution Subsystem contains no CSCIs at this time.

4.2.8 Configuration Dependent Subsystem

The Configuration Dependent Subsystem contains two HWCI: TCS-LS and TCS-SB. For more information on each HWCI, refer to Appendices A and B, respectively.

4.3 Concept of Execution

The purpose of the TCS is to provide a common command and control station for the family (includes Predator) of tactical UAVs. The TCS shall be designed to be scaleable and tailored to a wide range of users. (SSS011)[SSDD638] The TCS shall control a UAV on Reconnaissance, Intelligence, Surveillance, and Target Acquisition (RISTA) missions. (SSS008)[SSDD639] The TCS shall be capable of being interoperable with the installed payloads across the 5 levels of UAV interaction. (SSS012)[SSDD1003]

Figure 4.3-1 depicts a tactical scenario that illustrates all five possible levels of interaction for TCS operation. A shipboard UAV detachment launches an Outrider from a LHA-Class ship (Level 5) to observe the beachhead. Marines on board the LHA receive the UAV video via a TCS fed closed circuit television (Level 1). Marines and Sailors on other ships have a direct receipt of imagery via remote video terminals (Level 2). A Navy/Marine team receives AV and payload control of the LHA-launched Outrider to support a detachment ashore. The Air Force at a Forward Operating Location (FOL) 100 miles away receives freeze-frame images via C4I (Level 5) for situation awareness. To ensure their needs are met, the Army Corps has a direct, real time influence on the payload (Level 3), as well as a forward observer directly receiving imagery (Level 2). At the end of the mission the Outrider control is passed to the Launch and Recovery detachment (Level 5).

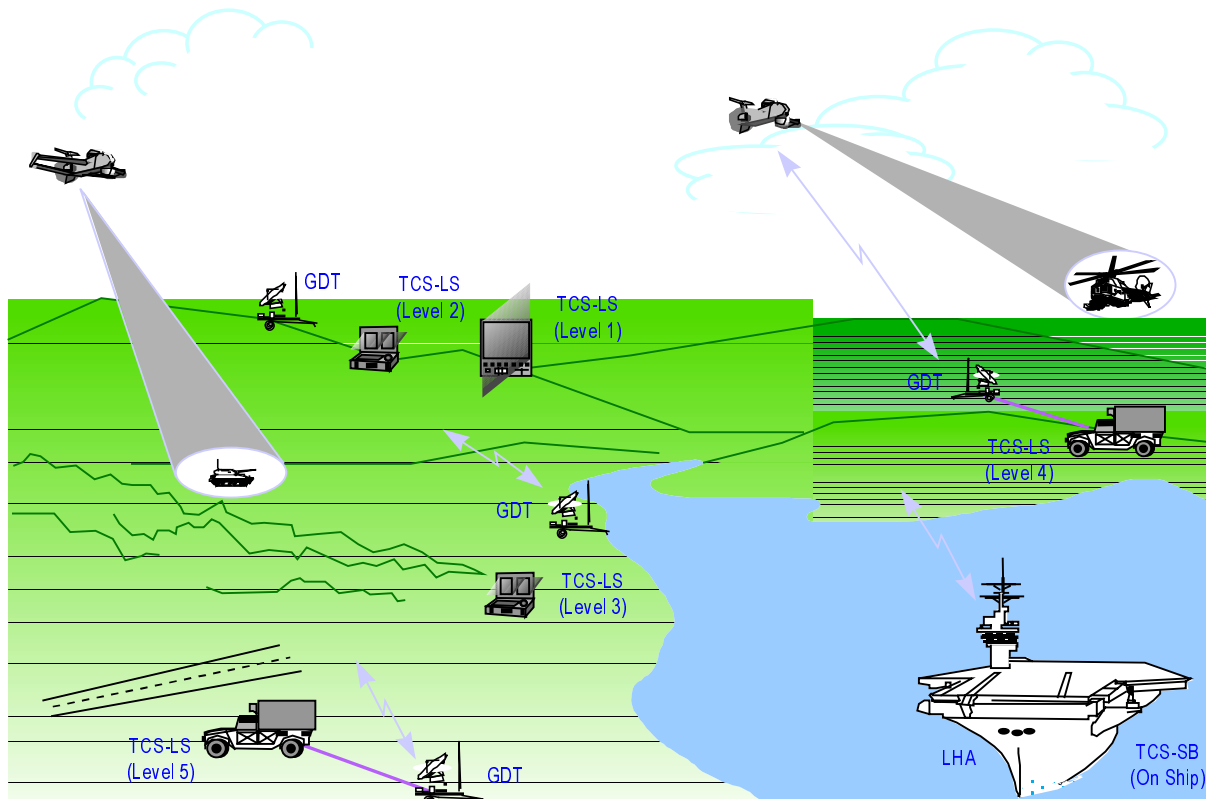


Figure 4.3-1 Tactical Scenario Illustrating All Five Levels of TCS Interaction

Table 4.3-1 depicts the necessary HWCIs for each of the five levels of TCS interaction. The software is the same for all levels of interaction and hardware configurations.

Table 4.3-1 Scaleability Options for TCS

| Items | Levels of Interaction | | | | | Comments |
|-------------------------------|-----------------------|----|----|----|----|--|
| | 1 | 2 | 3 | 4 | 5 | |
| AV Communications Subsystem | | | | | | |
| Datalink Terminal HWCI | 0 | 1 | 1 | 1 | 1 | Level 2 is receive only, so a smaller antenna could be used. 1 DCM is required per type of AV. |
| Datalink Control Module HWCI | 0 | 1 | 1 | 1 | 1 | |
| Antenna Assembly HWCI | 0 | 1 | 1 | 1 | 1 | |
| Launch & Recovery Subsystem | | | | | | |
| IBLS HWCI | 0 | 0 | 0 | 0 | 1 | Either IBLS or UCARS, depending on type of UAV. |
| UCARS HWCI | 0 | 0 | 0 | 0 | 1 | |
| Real Time Subsystem | | | | | | |
| Real Time Computer HWCI | 0 | 0 | 0 | 1 | 1 | Type of manual controls depends upon type of UAV. |
| Manual Controls HWCI | 0 | 0 | 0 | 0 | 1 | |
| Payload Subsystem | | | | | | |
| EO/IR Payload | -- | -- | -- | -- | -- | EO/IR payload functionality is included in the Operator Station Subsystem. SAR hardware is only needed if using SAR payload. |
| SAR Payload | 0 | 1 | 1 | 1 | 1 | |
| Operator Station Subsystem | | | | | | |
| Non-Real Time Computer HWCI | 1 | 1 | 1 | 2 | 2 | Video Support is needed depending upon mission. |
| Video Support HWCI | 1 | 1 | 1 | 1 | 1 | |
| Operator Output HWCI | 1 | 1 | 1 | 2 | 2 | |
| Operator Input HWCI | 1 | 1 | 1 | 2 | 2 | |
| Communications Subsystem | | | | | | |
| External Storage HWCI | | | | | | Components of Communications Subsystem needed depending upon branch of service and type of mission. |
| Printer HWCI | | | | | | |
| Intercom Equipment HWCI | | | | | | |
| C4I Support Equipment HWCI | | | | | | |
| Communications Equipment HWCI | | | | | | |

4.3.1 Flow of Execution Control

The TCS shall execute the states and modes shown in Figures 4.3.1-1, 4.3.1-2, and 4.3.3-3. (SSS014) [SSDD640] The states transition diagram is shown in Figure 4.3.1-1. The modes comprising the Start-Up State and Operations State are detailed in Figures 4.3.1-2 and 4.3.1-3, respectively. There are no modes associated with the Shut-down state.

The state of operation of TCS shall be readily apparent to the operator and to other network members. (SSS014) [SSDD641] The state of readiness shall be easily communicated to other network members. (SSS014) [SSDD642] Connectivity shall be easily identified by TCS communication protocols during system initiation. (SSS014) [SSDD643] Should system connectivity be disrupted during normal operations, line loss or link loss shall be readily communicated to the operator. (SSS014) [SSDD644]

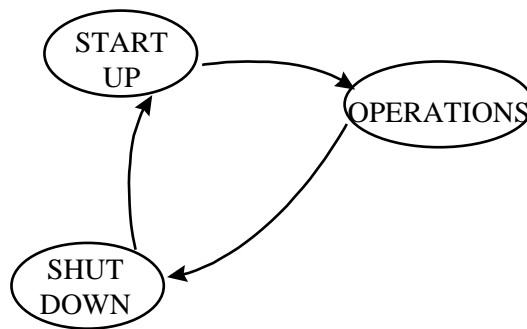


Figure 4.3.1-1 TCS State Diagram

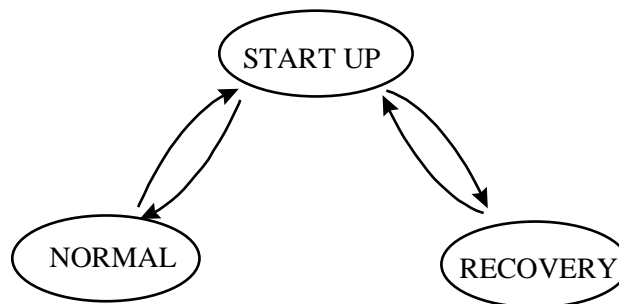


Figure 4.3.1-2 TCS Startup State and Associated Modes Diagram

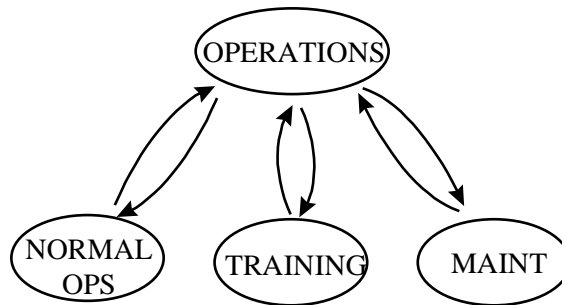


Figure 4.3.1-3 TCS Operations State and Associated Modes Diagram

The TCS data latency shall not be greater than that present in the Predator ground control station or Outrider ground control station, whichever is smaller. (SSS409) [SSDD645]

The data latency shall be no greater than as shown in tables 4.3.1-1 through table 4.3.1-13. (SSS409) [SSDD646]

Table 4.3.1-1 Operator AV Commands to Datalink Terminal Latency

| AV COMMAND INPUT | | LATENCY ALLOCATION |
|-------------------------|-----------------------------|--------------------|
| SENDER | RECEIVER | (msec) AVG. |
| OPERATOR INPUT HWCi | NRT COMPUTER | 0.5 |
| NRT COMPUTER | DII (X-WINDOW SERVER) | TBD |
| DII(X-WINDOW SERVER) | UAV COMMON CONTROL CSCI | TBD |
| UAV COMMON CONTROL CSCI | NRT COMPUTER | 30 |
| NRT COMPUTER | DS COMPUTER (VIA LOCAL LAN) | 3.25 |
| DS COMPUTER | DS CSCI | 0.25 |
| DS CSCI | DS COMPUTER | 5 |
| DS COMPUTER | RTP COMPUTER (VIA LINK LAN) | 0.25 |
| RTP COMPUTER | RTP CSCI | 0.25 |
| RTP CSCI | RTP COMPUTER | 5 |
| RTP COMPUTER | DCM COMPUTER (VIA AVSI LAN) | 0.25 |
| DCM COMPUTER | DCM CSCI | 0.25 |
| DCM CSCI | DCM COMPUTER | 15 |
| DCM COMPUTER | IDT (VIA RS-422 I/F) | 10 |
| | TOTAL | 70 + TBD |

Table 4.3.1-2 AV Monitoring Data from Datalink Terminal to Operator Latency

| AV COMMAND INPUT | | LATENCY ALLOCATION |
|-----------------------------|------------------------------|-----------------------|
| SENDER | RECEIVER | (msec) AVG. |
| IDT (VIA RS-422 I/F) | DCM COMPUTER | 10 |
| DCM COMPUTER | DCM CSCI | 0.5 |
| DCM CSCI | DCM COMPUTER | 5 |
| DCM COMPUTER (VIA AVSI LAN) | RTP COMPUTER | 0.25 |
| RTP COMPUTER | RTP MAIN | 5 |
| RTP MAIN | RTP COMPUTER | 0.25 |
| RTP COMPUTER | DS COMPUTER (VIA LINK LAN) | 0.25 |
| DS COMPUTER | DS CSCI | 5 |
| DS CSCI | DS COMPUTER | 0.25 |
| DS COMPUTER | NRT COMPUTER (VIA LOCAL LAN) | 3.25 |
| NRT COMPUTER | UAV COMMON CONTROL CSCI | TBD |
| UAV COMMON CONTROL CSCI | DII(X-WINDOW SERVER) | 10.25 |
| DII (X-WINDOW SERVER) | NRT COMPUTER | TBD |
| NRT COMPUTER | OPERATOR OUTPUT HWCi | 10 |
| TOTAL | | 50 + TBD |

Table 4.3.1-3 Operator Initiated Transmission of C4I Message Latency

| TRANSMISSION OF C4I MESSAGES | | LATENCY |
|------------------------------|-----------------------------|-----------|
| SENDER | RECEIVER | (MSEC) |
| Operator Input HWCi | NRT Computer | 0.5 |
| NRT Computer | Common UAV Control | TBD |
| Common UAV Control | C4I Interfaces | 100 |
| C4I Interfaces | DII COE | 50 |
| DII COE | NRT Computer | TBD |
| NRT Computer | C4I Support Equipment | 0.5 |
| C4I Support Equipment | MSE or SINCGARS | 0.5 |
| MSE or SINCGARS | Transmission Initialization | 0.5 |
| Total | | 202 + TBD |

Table 4.3.1-4 C4I Message Reception to Operator Latency

| C4I MESSAGE RECEPTION | | Latency |
|------------------------|-----------------------|-----------|
| Sender | Receiver | (msec) |
| Message Being Received | MSE or SINCGARS | 0.5 |
| MSE or SINCGARS | C4I Support Equipment | 0.5 |
| C4I Support Equipment | NRT Computer | 0.5 |
| NRT Computer | DII COE | TBD |
| DII COE | C4I Interfaces | TBD |
| C4I Interfaces | Common UAV Control | 100 |
| Common UAV Control | NRT Computer | 50 |
| NRT Computer | Operator Output HWCI | 0.5 |
| Operator Output HWCI | Displayed to Operator | 16 |
| Total | | 168 + TBD |

Table 4.3.1-5 Operator EO/IR Payload Commands to Datalink Terminal Latency

| PAYLOAD COMMAND INPUT | | LATENCY |
|-------------------------|-----------------------------|-------------|
| SENDER | RECEIVER | ALLOCATION |
| | | (msec) AVG. |
| OPERATOR INPUT HWCI | NRT COMPUTER | 0.5 |
| NRT COMPUTER | DII (X-WINDOW SERVER) | TBD |
| DII(X-WINDOW SERVER) | UAV COMMON CONTROL CSCI | TBD |
| UAV COMMON CONTROL CSCI | NRT COMPUTER | 50 |
| NRT COMPUTER | DS COMPUTER (VIA LOCAL LAN) | 3.25 |
| DS COMPUTER | DS CSCI | 0.25 |
| DS CSCI | DS COMPUTER | 10 |
| DS COMPUTER | RTP COMPUTER (VIA LINK LAN) | 0.25 |
| RTP COMPUTER | RTP CSCI | 0.25 |
| RTP CSCI | RTP COMPUTER | 10 |
| RTP COMPUTER | DCM COMPUTER (VIA AVSI LAN) | 0.25 |
| DCM COMPUTER | DCM CSCI | 0.25 |
| DCM CSCI | DCM COMPUTER | 15 |
| DCM COMPUTER | IDT (VIA RS-422 I/F) | 10 |
| TOTAL | | 100 + TBD |

Table 4.3.1-6 EO/IR Payload Data from Datalink Terminal to Operator Latency

| PAYLOAD STATUS DOWNLINK | | LATENCY |
|--------------------------------|------------------------------|--------------------|
| SENDER | RECEIVER | ALLOCATION |
| | | (msec) AVG. |
| IDT (VIA RS-422 I/F) | DCM COMPUTER | 10 |
| DCM COMPUTER | DCM CSCI | 0.5 |
| DCM CSCI | DCM COMPUTER | 5 |
| DCM COMPUTER (VIA AVSI LAN) | RTP COMPUTER | 0.25 |
| RTP COMPUTER | RTP MAIN | 10 |
| RTP MAIN | RTP COMPUTER | 0.25 |
| RTP COMPUTER | DS COMPUTER (VIA LINK LAN) | 0.25 |
| DS COMPUTER | DS CSCI | 10 |
| DS CSCI | DS COMPUTER | 0.25 |
| DS COMPUTER | NRT COMPUTER (VIA LOCAL LAN) | 3.25 |
| NRT COMPUTER | UAV COMMON CONTROL CSCI | TBD |
| UAV COMMON CONTROL CSCI | DII(X-WINDOW SERVER) | 40.25 |
| DII (X-WINDOW SERVER) | NRT COMPUTER | TBD |
| NRT COMPUTER | OPERATOR OUTPUT HWCI | 10 |
| TOTAL | | 90 + TBD |

Table 4.3.1-7 Operator SAR Payload Commands to Datalink Terminal Latency**(Table is TBD)****Table 4.3.1-8 SAR Payload Data from Datalink Terminal to Operator Latency****(Table is TBD)**

Table 4.3.1-9 Manual Control of AV Latency

| MANUAL CONTROL INPUT | | LATENCY |
|-----------------------------|-----------------------------|--------------------|
| SENDER | RECEIVER | ALLOCATION |
| | | (msec) AVG. |
| STICK | STK PROC | 0.5 |
| STK PROC | RTP COMPUTER | 10 |
| RTP COMPUTER | RTP CSCI | 35 |
| RTP CSCI | RTP COMPUTER | 0.25 |
| RTP COMPUTER | DCM COMPUTER (VIA AVSI LAN) | 0.25 |
| DCM COMPUTER | DCM CSCI | 0.25 |
| DCM CSCI | DCM COMPUTER | 13.75 |
| DCM COMPUTER | IDT (VIA RS-422 I/F) | 10 |
| TOTAL | | 70 |

**Table 4.3.1-10 Targeting Latency
(Table is TBD)****Table 4.3.1-11 Datalink Monitoring Latency**

| DOWNLINK STATUS | | LATENCY |
|-----------------------------|------------------------------|--------------------|
| SENDER | RECEIVER | ALLOCATION |
| | | (msec) AVG. |
| IDT (VIA RS-422 I/F) | DCM COMPUTER | 10 |
| DCM COMPUTER | DCM CSCI | 0.5 |
| DCM CSCI | DCM COMPUTER | 5 |
| DCM COMPUTER (VIA AVSI LAN) | RTP COMPUTER | 0.25 |
| RTP COMPUTER | RTP MAIN | 10 |
| RTP MAIN | RTP COMPUTER | 0.25 |
| RTP COMPUTER | DS COMPUTER (VIA LINK LAN) | 0.25 |
| DS COMPUTER | DS CSCI | 10 |
| DS CSCI | DS COMPUTER | 0.25 |
| DS COMPUTER | NRT COMPUTER (VIA LOCAL LAN) | 3.25 |
| NRT COMPUTER | UAV COMMON CONTROL CSCI | TBD |
| UAV COMMON CONTROL CSCI | DII(X-WINDOW SERVER) | 40.25 |
| DII (X-WINDOW SERVER) | NRT COMPUTER | TBD |
| NRT COMPUTER | OPERATOR OUTPUT HWCI | 10 |
| TOTAL | | 90 + TBD |

Table 4.3.1-12 Datalink Control Latency

| DATALINK COMMAND | | LATENCY |
|-------------------------|-----------------------------|-------------|
| SENDER | RECEIVER | ALLOCATION |
| | | (msec) AVG. |
| OPERATOR INPUT HWCI | NRT COMPUTER | 0.5 |
| NRT COMPUTER | DII (X-WINDOW SERVER) | TBD |
| DII(X-WINDOW SERVER) | UAV COMMON CONTROL S/W CSCI | TBD |
| UAV COMMON CONTROL CSCI | NRT COMPUTER | 50 |
| NRT COMPUTER | DS COMPUTER (VIA LOCAL LAN) | 3.25 |
| DS COMPUTER | DS CSCI | 0.25 |
| DS CSCI | DS COMPUTER | 10 |
| DS COMPUTER | RTP COMPUTER (VIA LINK LAN) | 0.25 |
| RTP COMPUTER | RTP CSCI | 0.25 |
| RTP CSCI | RTP COMPUTER | 10 |
| RTP COMPUTER | DCM COMPUTER (VIA AVSI LAN) | 0.25 |
| DCM COMPUTER | DCM CSCI | 0.25 |
| DCM CSCI | DCM COMPUTER | 15 |
| DCM COMPUTER | IDT (VIA RS-422 I/F) | 10 |
| TOTAL | | 100 + TBD |

**Table 4.3.1-13 TCS to TCS Latency
(Table is TBD)**

There shall be no modes of operation in the shutdown state. (SSS048) [SSDD647]

The TCS shall provide the functionality to have a maximum delay time of TBD from operator command to system acknowledgment and response. (SSS559) [SSDD648]

After emplacement at the operational site, TCS shall be capable of performing the activities shown in Table 4.3.1-14 within the maximum allotted time. (SSS441) [SSDD649]

Table 4.3.1-14 Activity Allotment Time

| Activity | Max Time | Comments |
|---|-----------------|-----------------------------------|
| NRT Computer placed in Operations State | TBD | TCS Specific |
| Mission Planning for 1 Waypoint Mission | TBD | Dependent upon type of UAV system |
| Support Hardware up and running | TBD | Dependent upon type of UAV system |
| Datalink Terminal Set Up (IDT) | TBD | TCS Specific |
| (SATCOM) | TBD | TCS Specific |
| (UAV Vendor) | TBD | Dependent upon type of UAV system |
| Safety Equipment in Place | TBD | Dependent upon type of UAV system |
| Preparing an AV for Flight | TBD | Dependent upon type of UAV system |
| Launch Single AV | TBD | Dependent upon type of UAV system |
| TOTAL | TBD | |

TCS shall be capable of operating continuously for a minimum of 72 hours. (SSS442) [SSDD650]

4.3.1.1 Normal Operations Mode Execution

The TCS shall allow operators to sub-divide in any manner these activities of execution between all TCSs connected together via C4I messages or hardwire connection. (SSS037)[SSDD651] The following describes each activity for the Normal Operations Mode:

In the Normal Operations Mode, all of the CSCIs shall be capable of executing concurrently. (SSS037) [SSDD652]

The TCS shall support 5 levels of UAV interaction: (SSS010) [SSDD653]

Level 1: receipt and transmission of secondary imagery and/or [as well as] data

Level 2: direct receipt of imagery and/or [as well as] data

Level 3: control of the UAV payload in addition to direct receipt of imagery/data

Level 4: control of the UAV, less launch and recovery, plus all the functions of level three

Level 5: capability to have full function and control of the UAV from takeoff to landing

When in the Operations State, the TCS shall be capable of operating in three modes: normal operations mode, training operations mode, and maintenance operations mode. (SSS032) [SSDD654]

In the Normal Operations Mode the TCS shall support the following functions: (SSS037) [SSDD655]

1. Mission Planning
2. Mission Control and Monitoring
3. Payload Product Management
4. Target Coordinate Development
5. C4I Systems Interface

Functions under the Normal Operations Mode shall operate concurrently without precluding or excluding any of the other functions, in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS038) [SSDD656]

All of the activities, described in sections 4.3.1.1.1 through 4.3.1.1.23, shall be capable of executing concurrently. (SSS038) [SSDD657]

4.3.1.1.1 C4I Communication Reception

C4I Interfaces CSCI, Common UAV Control CSCI, DII/COE CSCI, and Operator Output HWCI for the reception and displaying of C4I messages. This activity is started when the C4I Support Equipment HWCI receives a message. The C4I Support Equipment HWCI notifies C4I Interfaces CSCI that a message is being received. The C4I Interfaces CSCI working with the C4I Support Equipment HWCI and Non-Real Time Computer HWCI coordinate the reception of the message into the Non-Real Time Computer's memory. When the message is received or errors occur, C4I Interfaces CSCI shall notify the operator via Common UAV Control CSCI, and Operator Output HWCI, completing this activity. (SSS239) [SSDD1004]

The C4I reception data flows from the C4I Support Equipment HWCI to the Non-Real Time Computer HWCI to Common UAV Control CSCI to Operator Output HWCI to display the received C4I message. The C4I Interfaces CSCI also logs the messages. This is shown in figure 4.3.1.1.1-1.

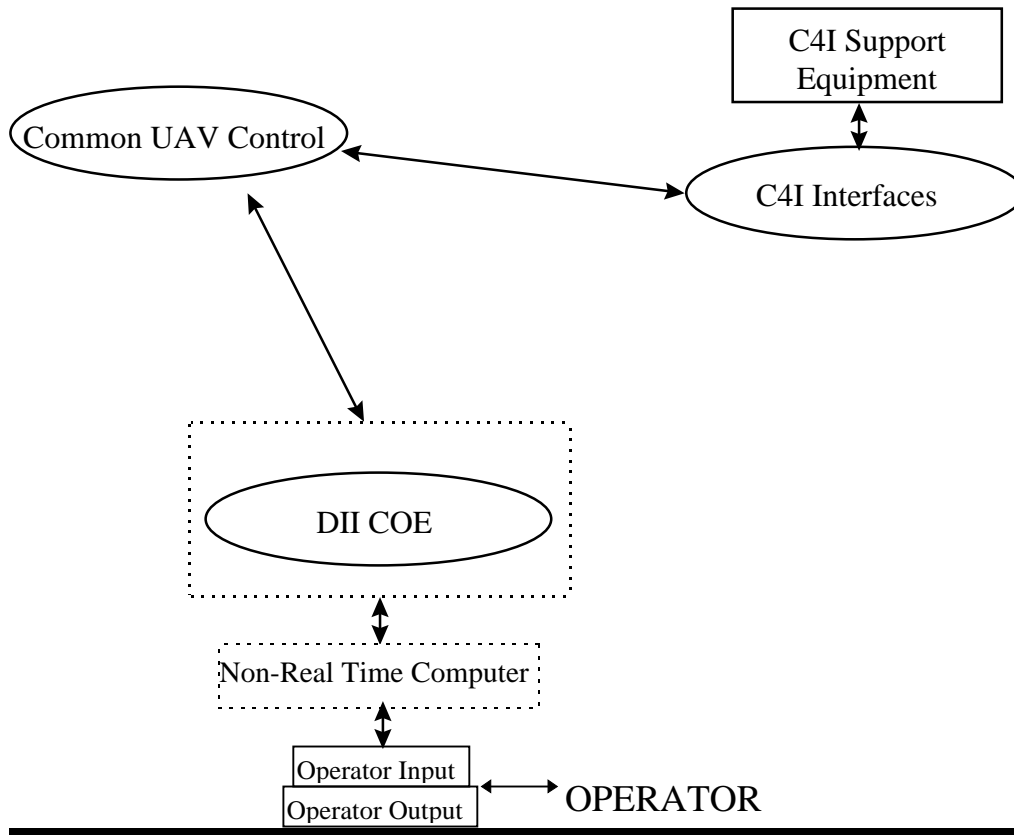


Figure 4.3.1.1.1-1 C4I Communication Reception Data Flow Diagram

4.3.1.1.2 C4I Communication Transmission

This activity involves the Operator Output HWCI, Operator Input HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, C4I Interfaces CSCI, C4I Support Equipment HWCI, for the transmission of C4I messages. This activity is normally started when the operator initiates a send C4I message command. The C4I Interfaces CSCI working with the Non-Real Time Computer HWCI, C4I Support Equipment HWCI, and MSE/SINCGARS coordinate the transmission of the message. When errors occur in the transmission process, C4I Interfaces CSCI shall notify the operator via Common UAV Control CSCI, and Operator Output HWCI. (SSS239) [SSDD658] This activity is completed after the successful message transmission or the notification of error has been provided to the operator. The C4I Interfaces CSCI also logs the messages transmission. This is shown in figure 4.3.1.1.2-1.

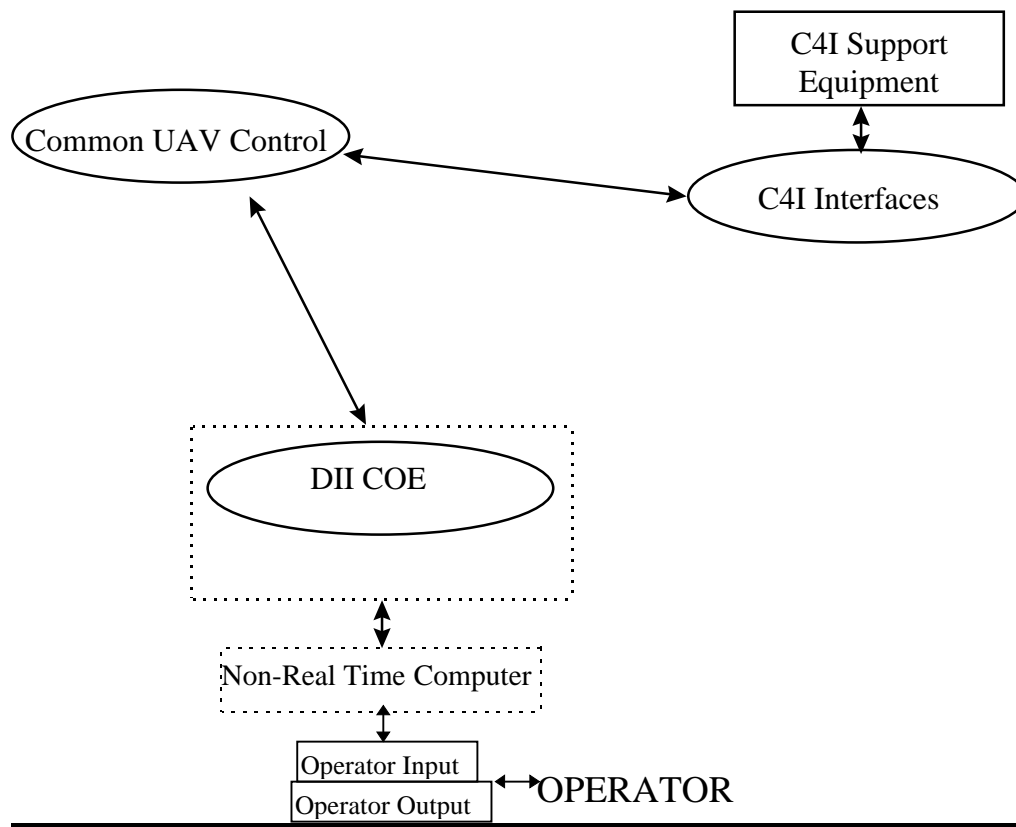


Figure 4.3.1.1.2-1 C4I Communication Transmission Data Flow Diagram

4.3.1.1.3 Transfer Control of AV

This activity involves the Operator Output HWCI, Operator Input HWCI, Common UAV Control CSCI, C4I Interfaces CSCI, Non-Real Time Computer HWCI, C4I Support Equipment HWCI, and a remote TCS. This activity is started when the operator indicates transfer of control of the AV to another TCS. When control is being transferred to a remote TCS, the Common UAV Control CSCI shall coordinate the transfer through C4I messages or via hardwire connection. (SSS239) [SSDD659] When errors occur in the transfer process, the Common UAV Control CSCI shall notify the operator. This activity is completed after the successful transfer of control or an error message has been provided to the operator. (SSS115) [SSDD660] This is shown in figure 4.3.1.1.3-1.

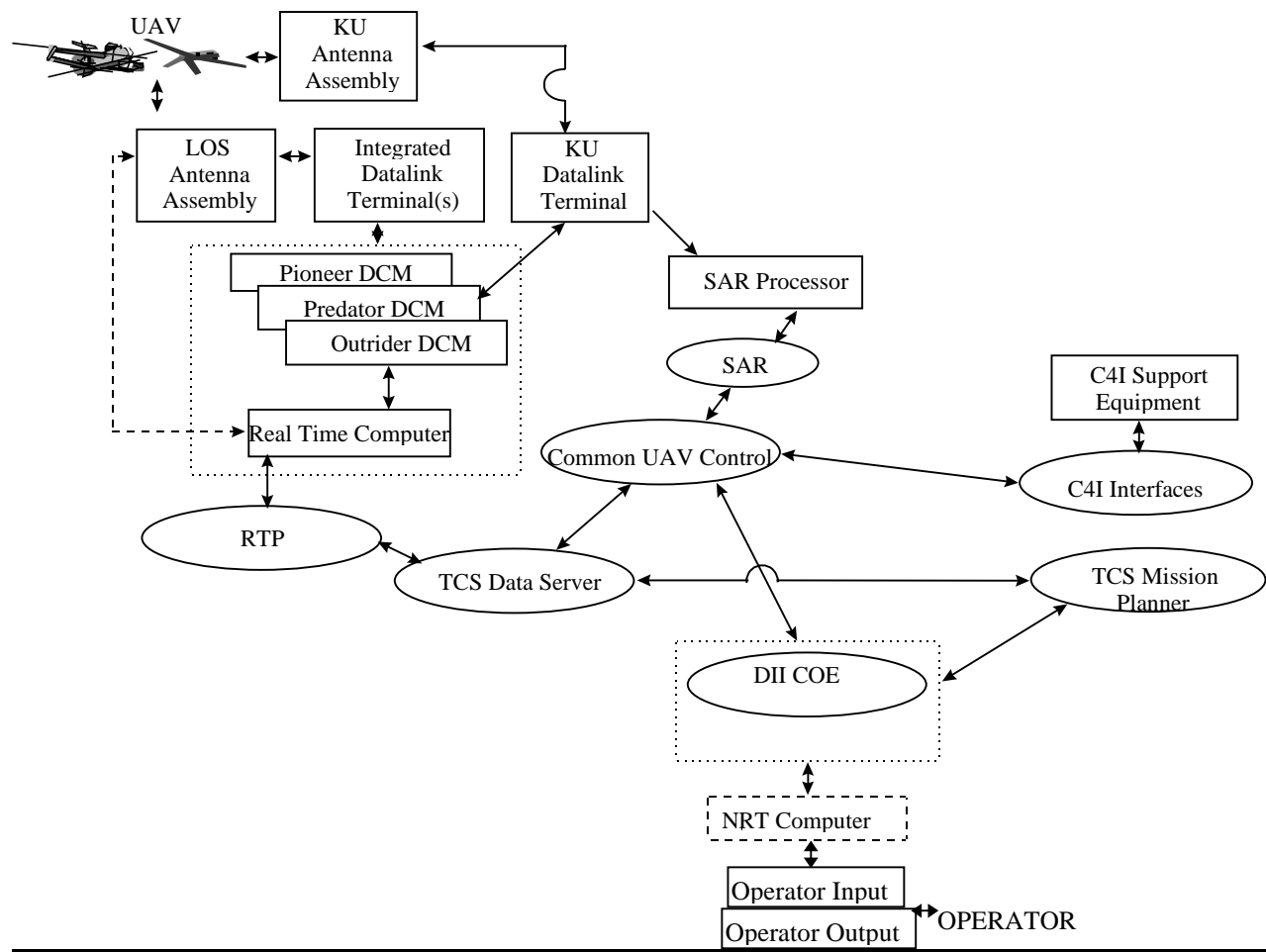


Figure 4.3.1.1.3-1 Transfer Control of an AV Data Flow Diagram

4.3.1.1.4 Receive Control of AV

This activity involves the Operator Output HWCI, Operator Input HWCI, Common UAV Control CSCI, C4I Interfaces CSCI, Non-Real Time Computer HWCI, C4I Support Equipment HWCI, and a remote TCS. This activity is started when the operator indicates receipt of control of the AV from another TCS. When control is being received by a remote TCS, the Common UAV Control CSCI shall coordinate the transfer through C4I messages or via hardwire connection. (SSS115) [SSDD661] When errors occur in the receive process, the Common UAV Control CSCI shall notify the operator. (SSS115) [SSDD662] This activity is completed after the successful receipt of control or an error message has been provided to the operator. This is shown in figure 4.3.1.1.4-1.

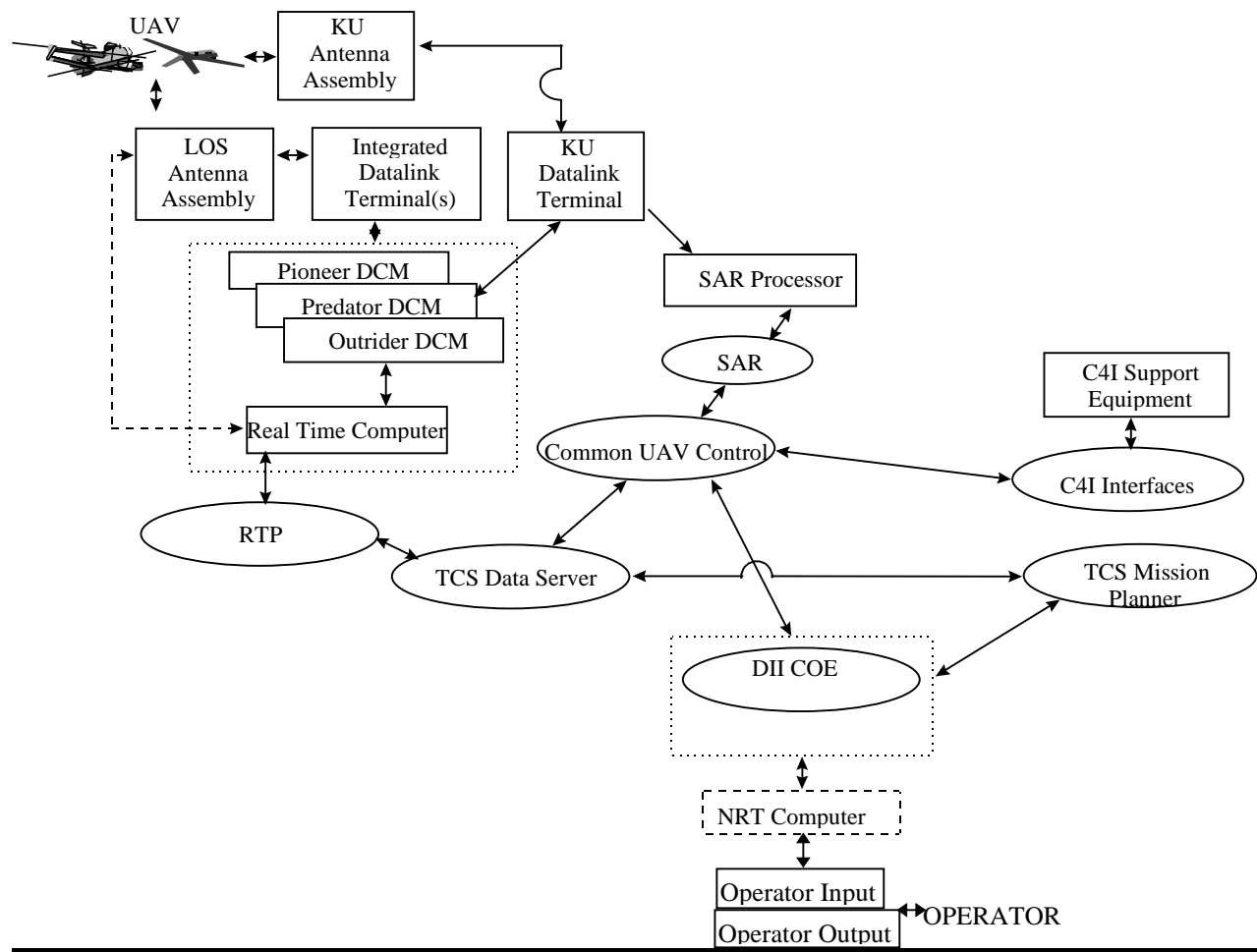


Figure 4.3.1.1.4-1 Receipt of AV Control Data Flow Diagram

4.3.1.1.5 Transfer Control of Payload

This activity involves the Operator Output HWCI, Operator Input HWCI, Common UAV Control CSCI, C4I Interfaces CSCI, Non-Real Time Computer HWCI, C4I Support Equipment HWCI, and a remote TCS. This activity is started when the operator indicates transfer of control of the Payload to another TCS. The Common UAV Control CSCI shall coordinate the transfer through C4I messages or via hardware connection. (SSS239) [SSDD663] When errors occur in the transfer process, the Common UAV Control CSCI shall notify the operator. (SSS239) [SSDD664] This activity is completed after the successful transfer of control or an error message has been provided to the operator. This is shown in figure 4.3.1.1.5-1.

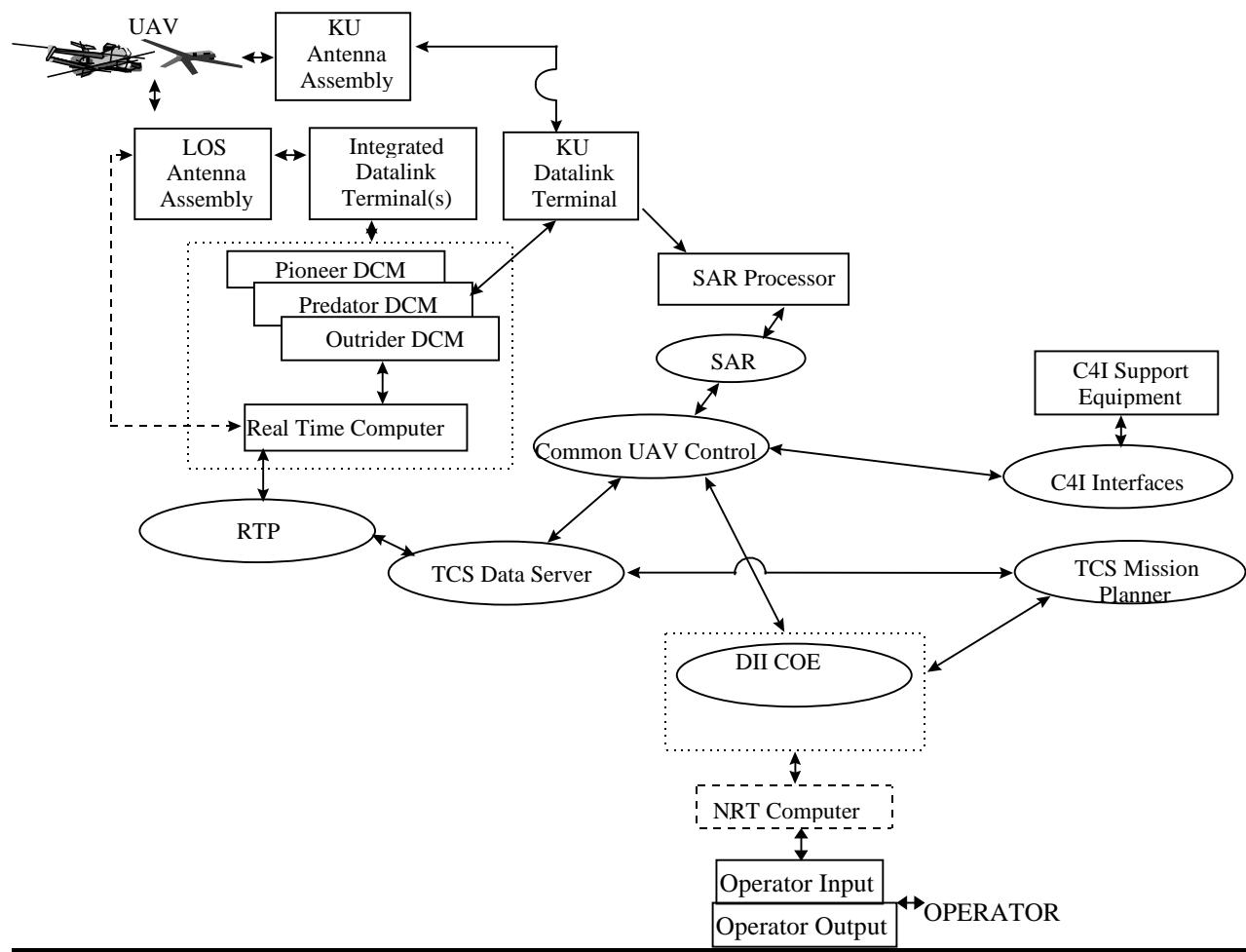


Figure 4.3.1.1.5-1 Transfer of Payload Control Data Flow Diagram

4.3.1.1.6 Receive Control of Payload

This activity involves the Operator Output HWCI, Operator Input HWCI, Common UAV Control CSCI, C4I Interfaces CSCI, Non-Real Time Computer HWCI, C4I Support Equipment HWCI, and a remote TCS. This activity is started when the operator indicates receipt of control of the Payload from another TCS. The Common UAV Control CSCI shall coordinate the receipt through C4I messages or via hardware connection. (SSS147) [SSDD665] When errors occur in the receive process, the Common UAV Control CSCI shall notify the operator. (SSS147) [SSDD666] This activity is completed after the successful receipt of control or an error message has been provided to the operator. This is shown in figure 4.3.1.1.6-1.

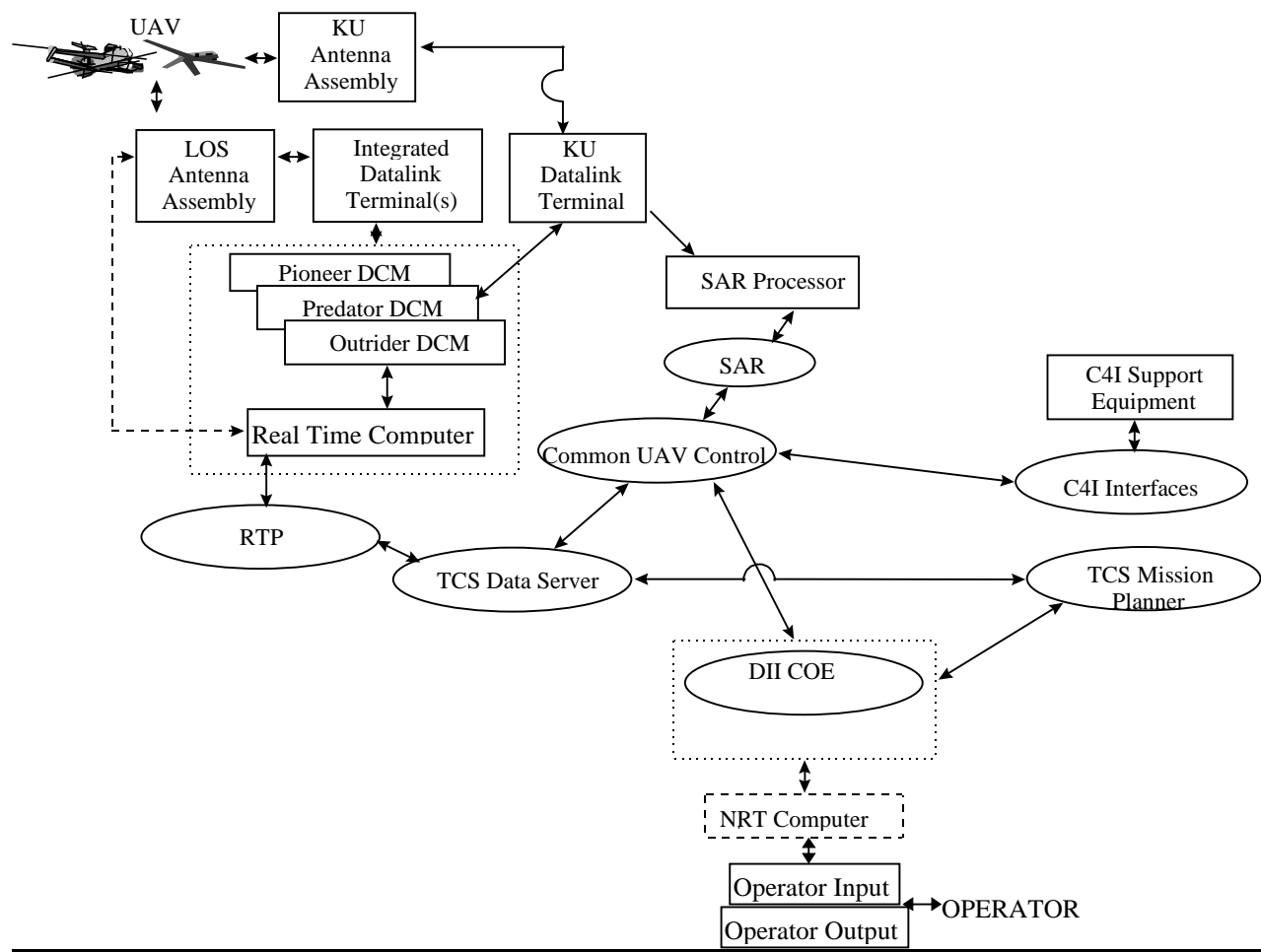


Figure 4.3.1.1.6-1 Receipt of Payload Control Data Flow Diagram

4.3.1.1.7 AV Launch

This activity involves TBD. This activity is started when the operator TBD. When errors occur in the AV Launch process, the Common UAV Control CSCI shall notify the operator. This activity is completed after the successful AV Launch or TBD. (SSS113) [SSDD667] This is shown in figure 4.3.1.1.7-1.

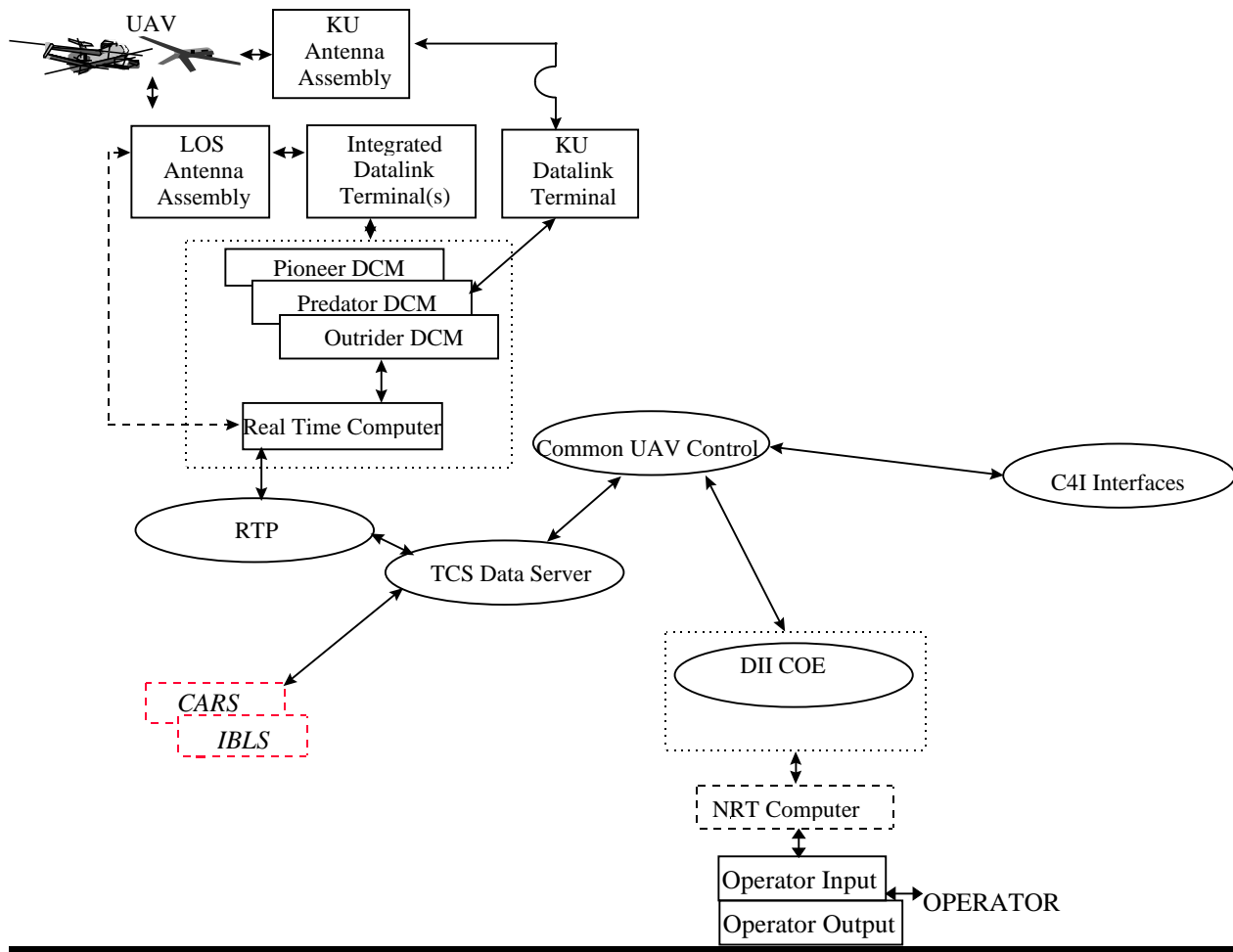


Figure 4.3.1.1.7-1 AV Launch Data Flow Diagram

4.3.1.1.8 AV Recovery

This activity involves TBD. This activity is started when the operator TBD. When errors occur in the AV Recovery process, the Common UAV Control CSCI shall notify the operator. (SSS113) [SSDD668] This activity is completed after the successful AV Recovery or TBD. This is shown in figure 4.3.1.1.8-1.

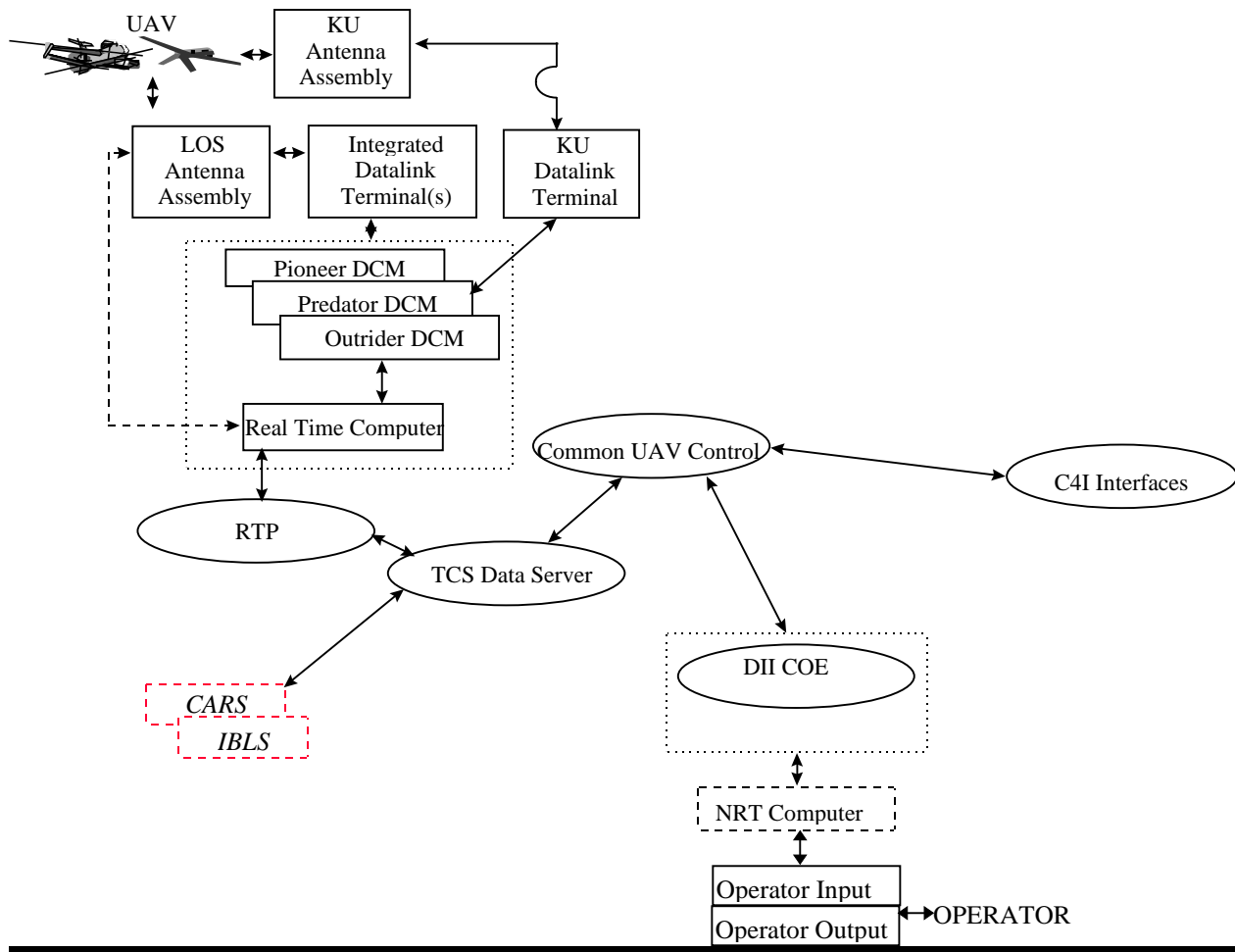


Figure 4.3.1.1.8-1 AV Recovery Data Flow Diagram

4.3.1.1.9 AV(s) Monitoring

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, and Operator Output HWCI to allow the operator to monitor the AV. This activity is initiated upon establishing communication with an AV. Once communication is established, the Datalink Terminal HWCI continuously relays AV data to the Common UAV Control CSCI. The Common UAV Control CSCI processes this information and presents it to the operator. This activity is only completed when the AV is recovered or control of the AV is transferred to another TCS. The data received is logged by the Common UAV Control CSCI. This is shown in figure 4.3.1.1.9-1.

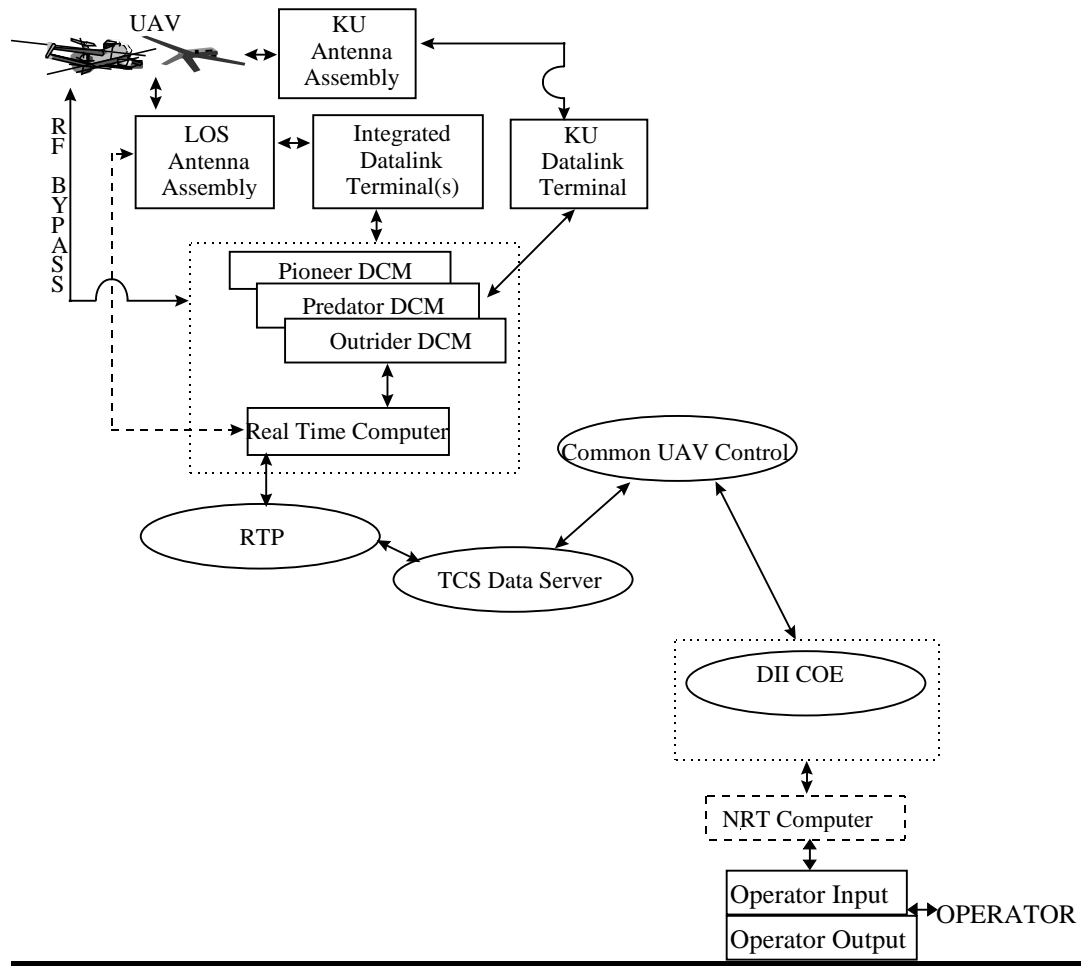


Figure 4.3.1.1.9-1 TCS AV Monitor Data Flow Diagram

4.3.1.1.10 AV(s) Control

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, Operator Input HWCI, and Operator Output HWCI to allow the operator to control the AV. This activity is initiated upon establishing communication with an AV. Once communication is established, the Datalink Terminal HWCI relays AV flight commands from the Common UAV Control CSCI. This activity is only completed when the AV is recovered or control of the AV is transferred to another TCS. The commands transferred to the AV are logged by the Common UAV Control CSCI. This is shown in figure 4.3.1.1.10-1.

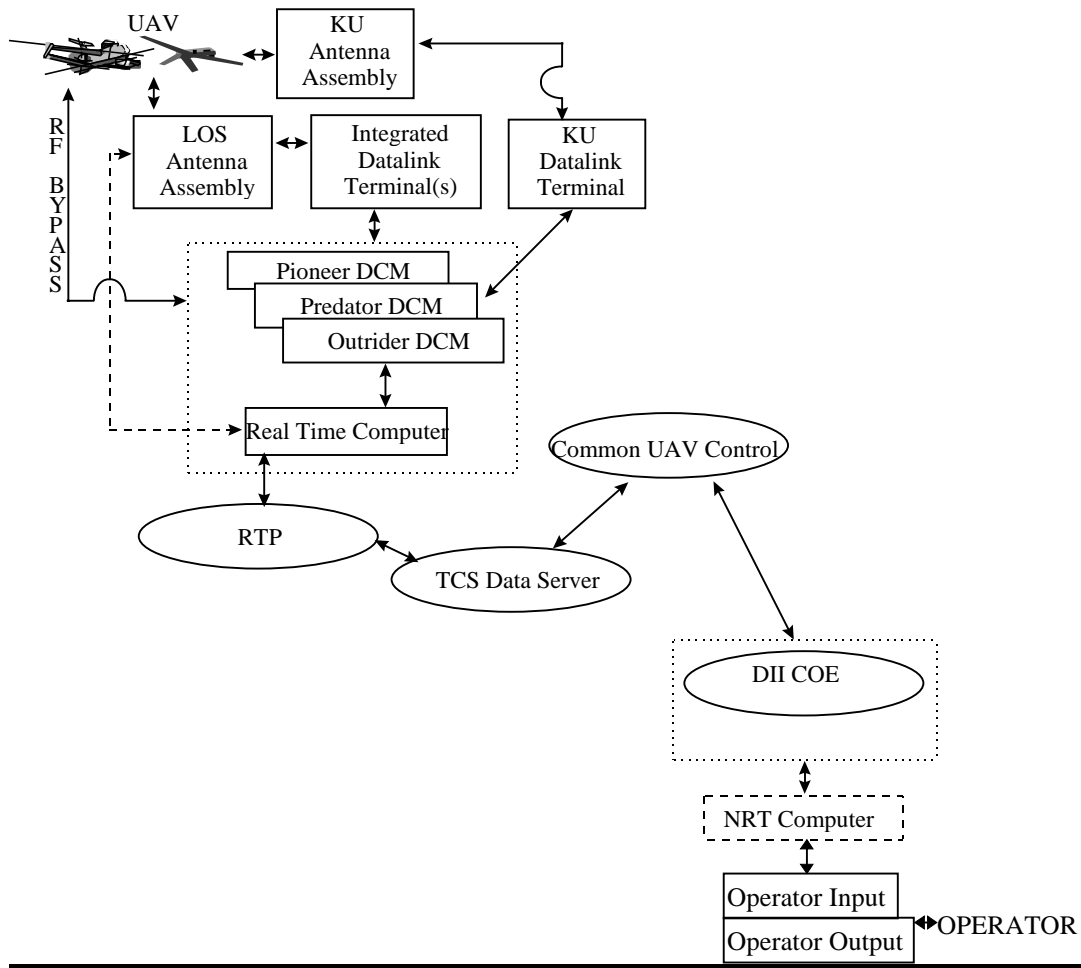


Figure 4.3.1.1.10-1 TCS AV Control Data Flow Diagram

4.3.1.1.11 Payload Monitoring

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, Operator Input HWCI, and Operator Output HWCI to allow the operator to monitor the Payload. This activity is initiated upon establishing communication with an AV. Once communication is established, the Datalink Terminal HWCI continuously relays Payload data to the Common UAV Control CSCI. The Common UAV Control CSCI processes this information and presents it to the operator. This activity is only completed when the AV is recovered or control of the AV or Payload is transferred to another TCS. The data received is logged by the Common UAV Control CSCI. This is shown in figure 4.3.1.1.11-1.

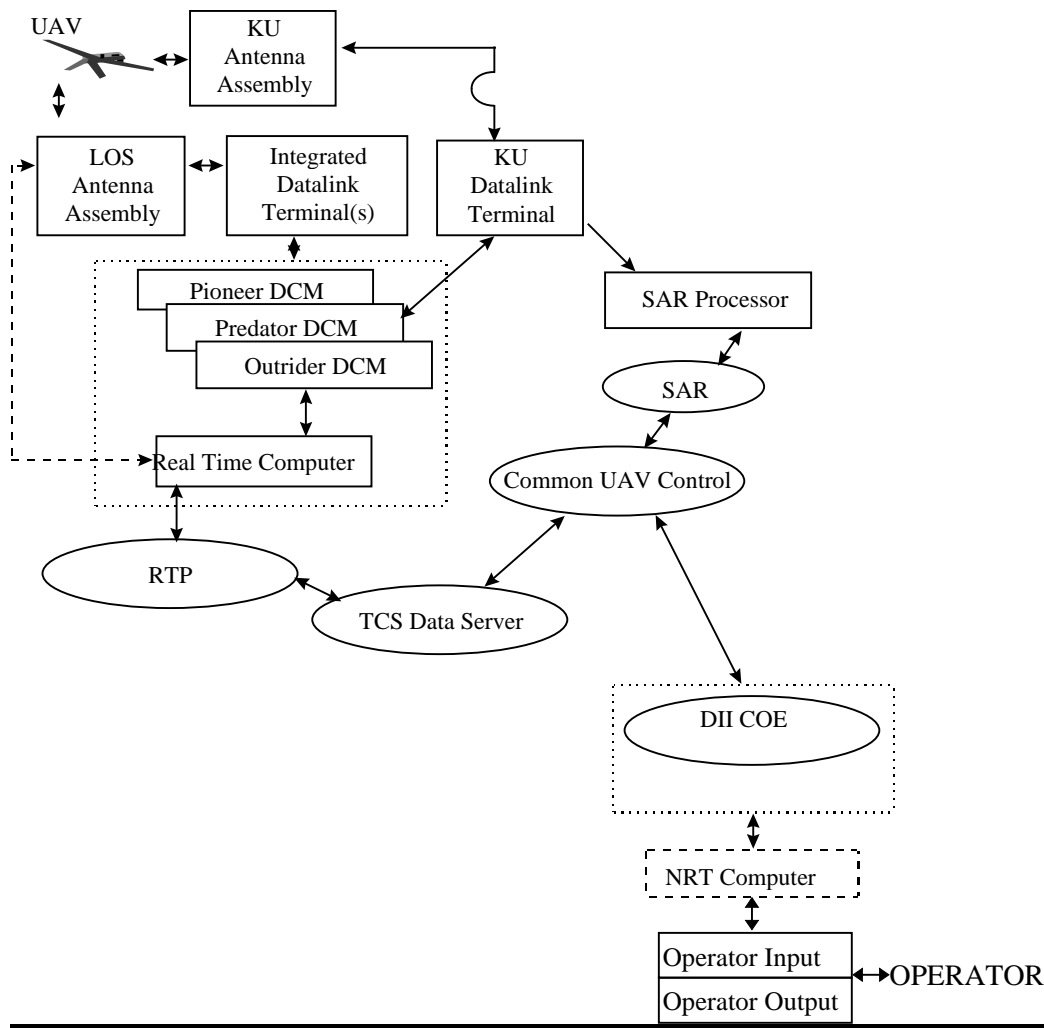


Figure 4.3.1.1.11-1 TCS Payload Monitoring Data Flow Diagram

4.3.1.1.12 Payload Control

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, Operator Input HWCI, and Operator Output HWCI to allow the operator to control the Payload. This activity is initiated upon establishing communication with an AV. Once communication is established, the Datalink Terminal HWCI relays Payload commands from the Common UAV Control CSCI. This activity is only completed when the AV is recovered or control of the AV or Payload is transferred to another TCS. The commands transferred are logged by the Common UAV Control CSCI. This is shown in figure 4.3.1.1.12-1.

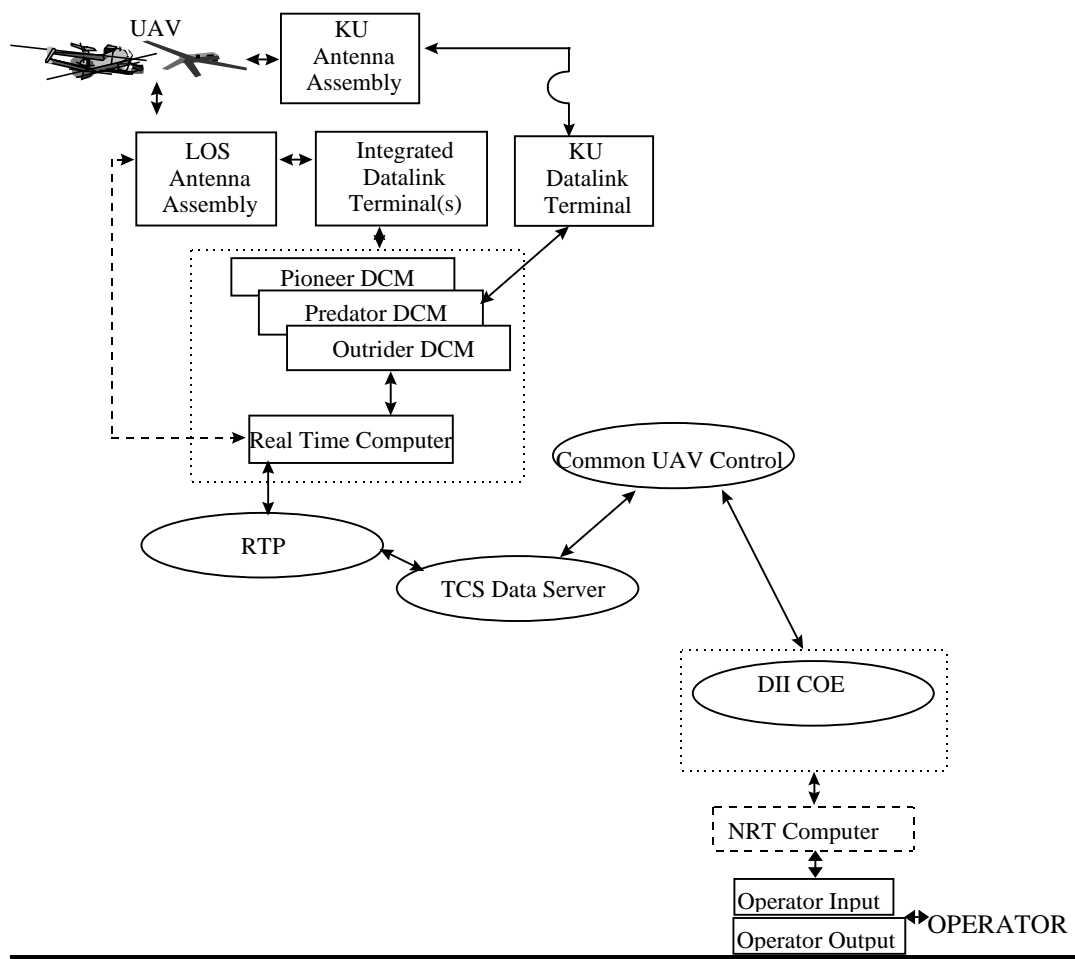


Figure 4.3.1.1.12-1 TCS Payload Control Data Flow Diagram

4.3.1.1.13 Payload Data Reception, Utilization, and Storage

This activity involves the Operator Input HWCI, Operator Output HWCI, Common UAV Control CSCI, Non-Real Time Computer HWCI, Datalink Terminal HWCI, SAR Processor HWCI, SAR CSCI, Video Support Equipment HWCI, Printer HWCI, and External Storage HWCI. This activity is initiated upon establishing communication with an AV and determining that the Payload is operating. Once initiated, the Datalink Terminal HWCI relays Payload data to the Common UAV Control CSCI.

When the Payload is a SAR, the SAR Processor HWCI and SAR CSCI shall receive data from the Ku Datalink Terminal HWCI, process it, and send processed SAR data to Common UAV Control CSCI for further processing. (SSS330) [SSDD669] The Common UAV Control CSCI presents the SAR data to the operator who determines what SAR data is to be processed for dissemination. A NITF 2.0 file may be created and stored for later utilization. Payload SAR imagery shall be recorded on the Digital Linear Tape Drive HWCI. (SSS330) [SSDD670] This activity is completed when either the operator commands its completion or this activity for the Payload is transferred to another TCS.

When the Payload is an EO/IR, the Video Support HWCI shall receive data from the Integrated Datalink Terminal HWCI. (SSS190) [SSDD671] The Video Support HWCI then routes the Payload Video to the Real Time Computer HWCI which processes it and sends the processed Video to the Operator Input HWCI, and Operator Output HWCI and on to the Common UAV Control CSCI for further processing. The Common UAV Control CSCI presents the Video to the operator who determines the video to be captured as a freeze frame for further processing and dissemination. A NITF 2.0 file shall be created from the freeze frame video and associated telemetry data and stored for later utilization. EO/IR video imagery shall be recorded on the VCR HWCI. (SSS185) [SSDD672] This activity is completed when either the operator commands its completion or this activity for the Payload is transferred to another TCS. This is shown in figure 4.3.1.1.13-1.

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4.3.1.1.14 Targeting

This is a specific utilization of Payload data that involves the Common UAV Control CSCI, Operator Input HWCI, and Operator Output HWCI. This activity is initiated when the operator determines that a possible target exists and commands the Common UAV Control CSCI to develop accurate target coordinates and target location error estimates. The Targeting information is presented to the operator who determines when and if the Targeting information is transmitted to external C4I systems. This activity is completed when accurate Targeting information is produced. This is shown in figure 4.3.1.1.14-1.

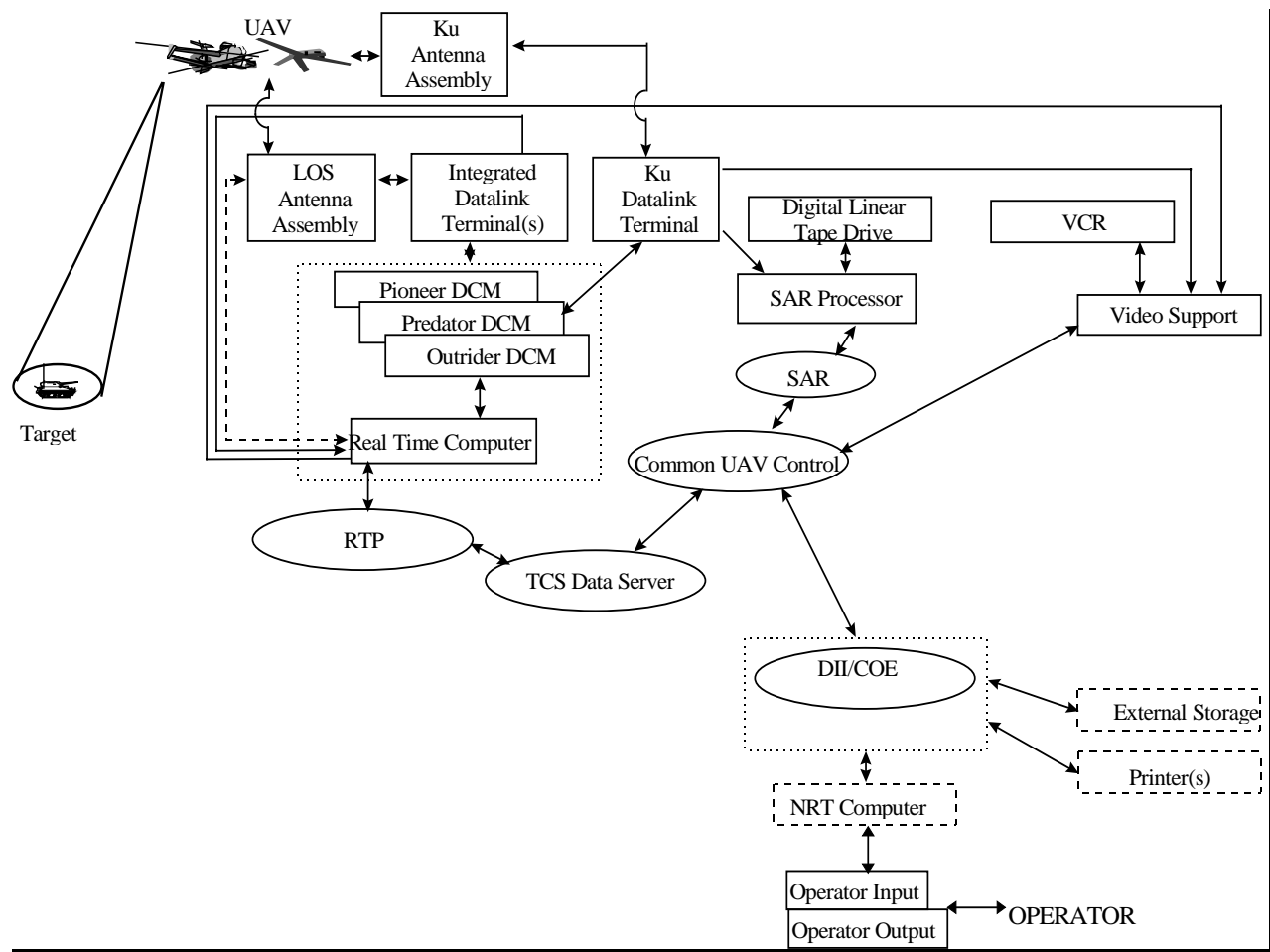


Figure 4.3.1.1.14-1 Targeting Flow Diagram

4.3.1.1.15 Datalink Monitoring

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, and Operator Output HWCI to allow the operator to monitor the Datalink(s). This activity is initiated when the Datalink is established. Once initiated, the Datalink Terminal HWCI continuously relays Datalink data it receives to the Common UAV Control CSCI. The Common UAV Control CSCI processes this information and presents it to the operator. This activity is completed when the Datalink is deactivated. The Common UAV Control CSCI shall log datalink status information. (SSS177) [SSDD673] This is shown in figure 4.3.1.1.15-1.

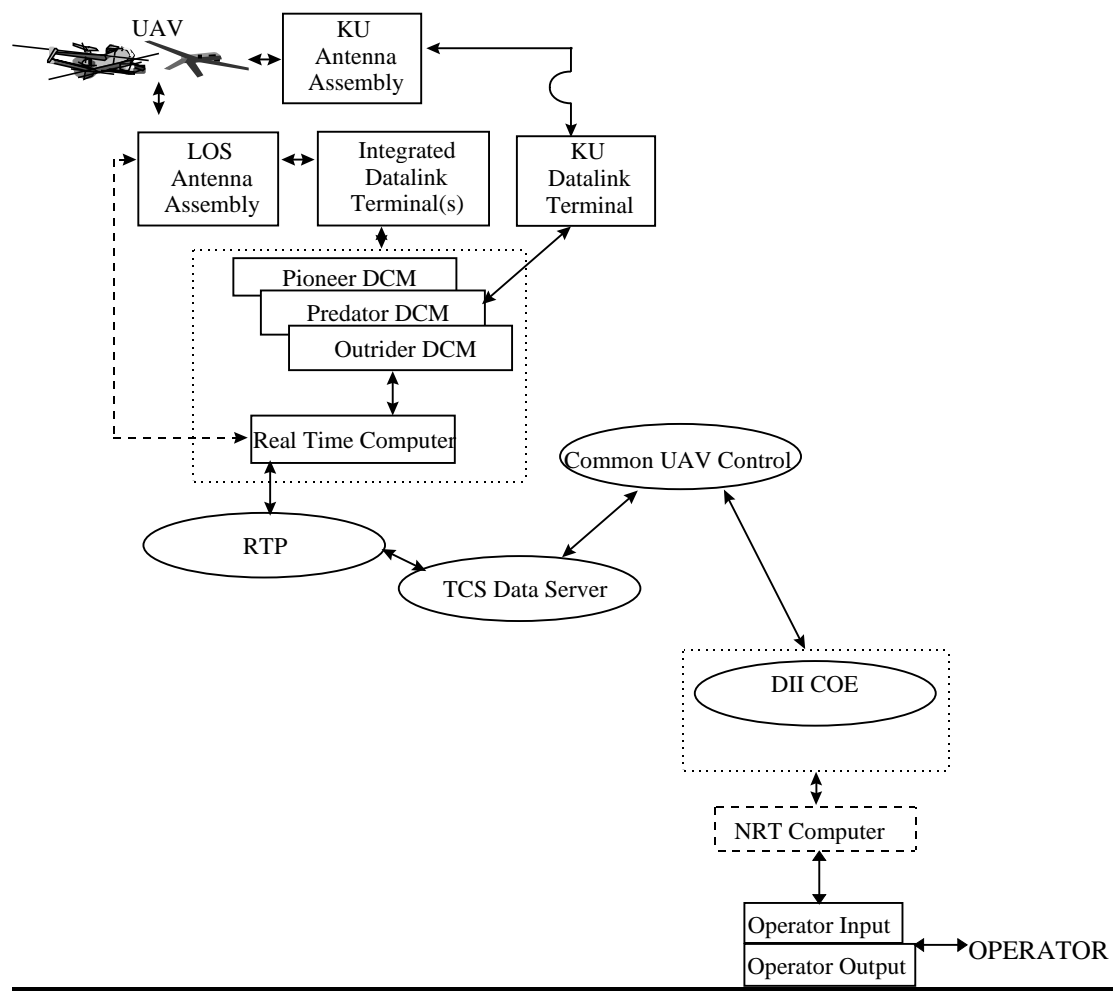


Figure 4.3.1.1.15-1 TCS Datalink Monitoring Data Flow Diagram

4.3.1.1.16 Datalink Control

This activity involves the Datalink Terminal HWCI, Non-Real Time Computer HWCI, Common UAV Control CSCI, Operator Output HWCI, and Operator Input HWCI to allow the operator to control the Datalink(s). This activity is initiated when the Datalink is established. Once initiated, the Common UAV Control CSCI relays commands to the Datalink. This activity is completed when the Datalink is deactivated. The Common UAV Control CSCI shall log datalink command messages. (SSS177) [SSDD674] This is shown in figure 4.3.1.1.16-1.

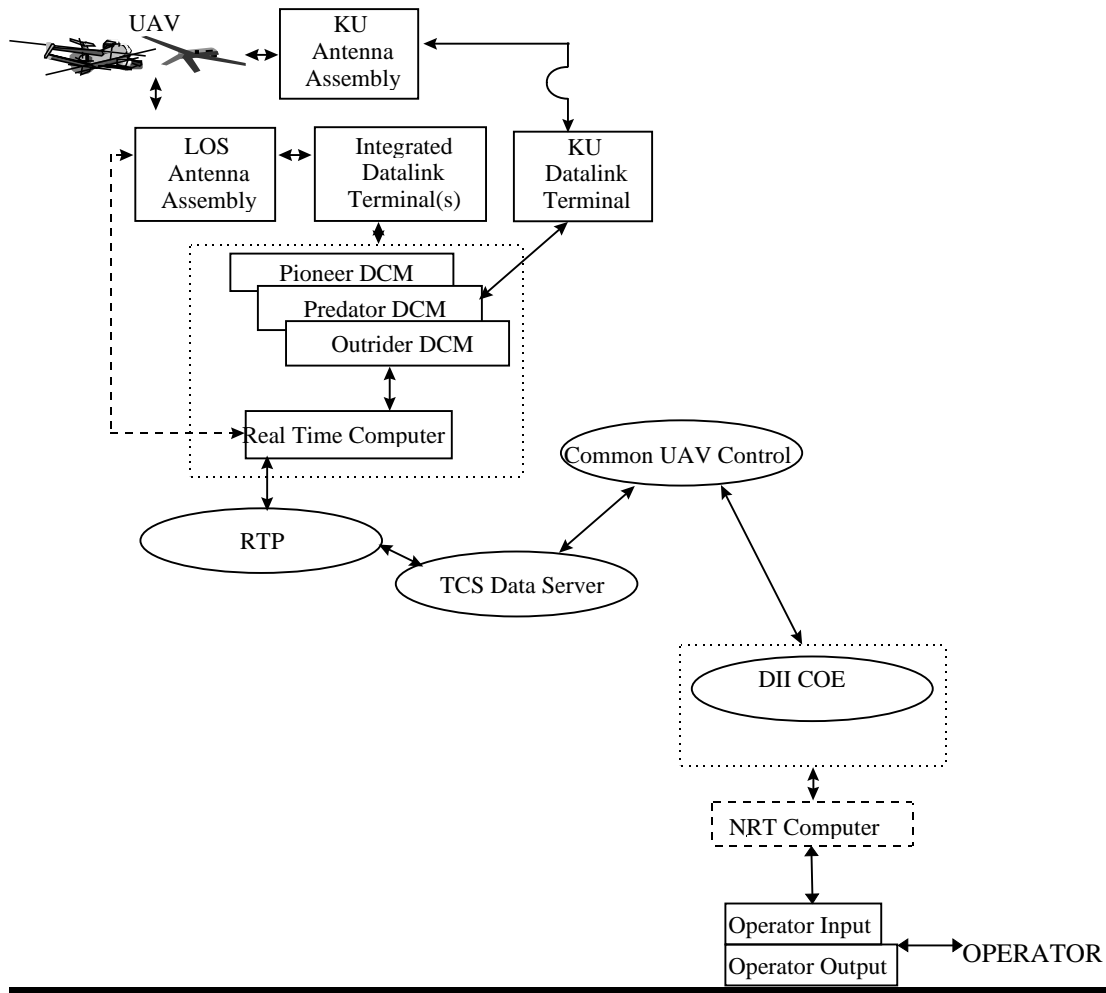


Figure 4.3.1.1.16-1 TCS Datalink Control Data Flow Diagram

4.3.1.1.17 Mission Planning

This activity involves the Operator Output HWCI, Operator Input HWCI, TCS Mission Planner CSCI, DII/COE CSCI, C4I Interfaces CSCI, Common UAV Control CSCI, and Non-Real Time Computer HWCI to allow the operator to plan, store, and retrieve Mission Plans. This activity is initiated when the operator selects the mission planning activity to commence. The TCS Mission Planner CSCI shall perform the mission planning actions entered by the operator and perform the appropriate display processing to provide feedback to the operator on the mission plan. (SSS050) [SSDD675] The C4I Interfaces CSCI and the TCS Mission Planner CSCI shall be able to transmit and receive Mission Plans. (SSS055) [SSDD676] This activity is completed when the operator commands its completion. This is shown in figure 4.3.1.1.17-1.

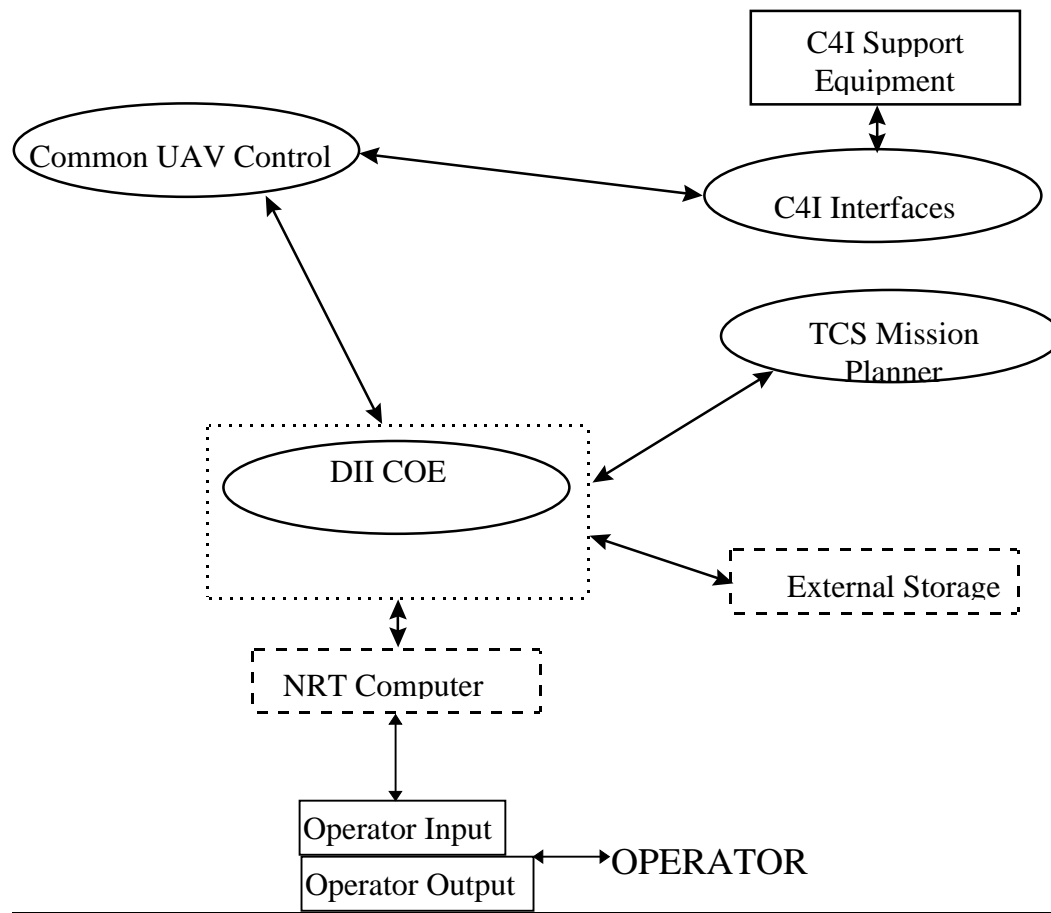


Figure 4.3.1.1.17-1 TCS Mission Planning Data Flow Diagram

4.3.1.1.18 VCR Control

This activity involves the Operator Output HWCI, Operator Input HWCI, Common UAV Control CSCI, Non-Real Time Computer HWCI, Video Support HWCI, and VCR HWCI to allow the operator to control the VCR. This activity is initiated when the operator selects the VCR control activity to commence. Common UAV Control CSCI shall relay VCR commands entered by the operator via the Video Support HWCI and perform the appropriate display processing to provide feedback to the operator. (SSS334) [SSDD677] This activity is completed when the operator commands its completion. This is shown in figure 4.3.1.1.18-1.

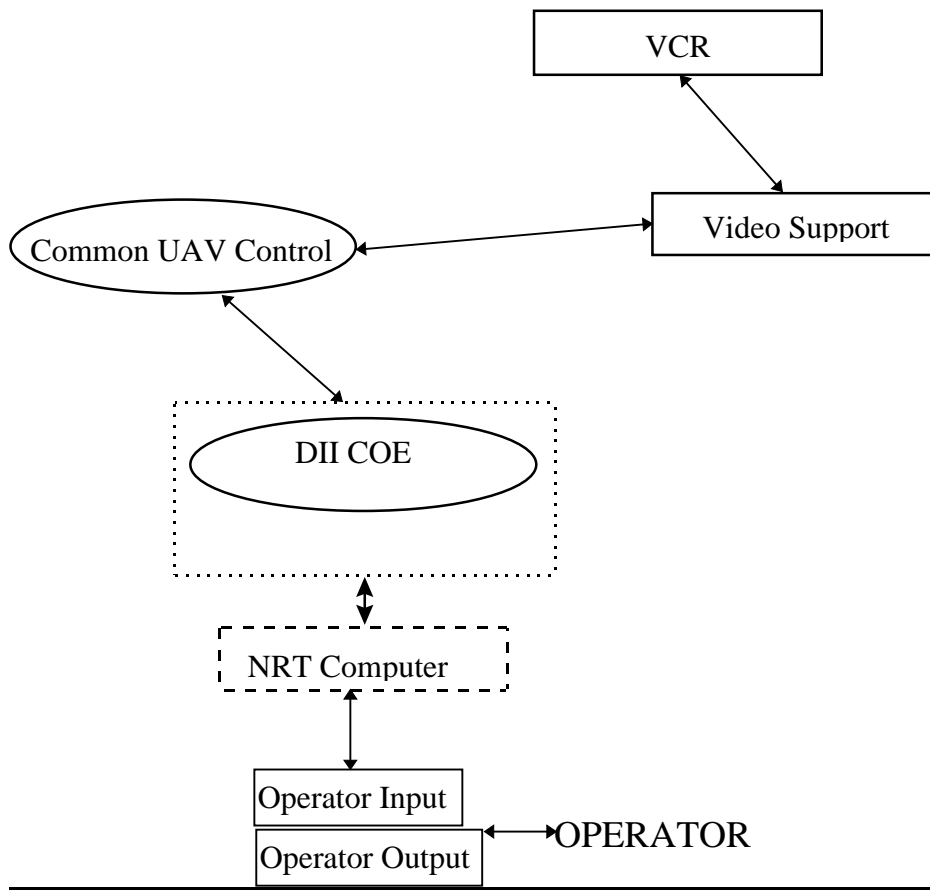


Figure 4.3.1.1.18-1 TCS VCR Control Data Flow Diagram

4.3.1.1.19 Printer Control

This activity involves the Operator Output HWCI, Operator Input HWCI, DII/COE CSCI, Common UAV Control CSCI, Non-Real Time Computer HWCI, and Printer HWCI to allow the operator to print designated information. This activity is initiated when the operator selects information to be printed. The Common UAV Control CSCI shall allow the operator to designate what information is to be printed. (SSS338) [SSDD678] The DII/COE CSCI shall provide the Printer HWCI commands and relay the information to the Printer HWCI to be printed and provide the appropriate feedback to the Common UAV Control and the operator. (SSS314) [SSDD679] This activity is completed when the Printer HWCI has printed the information. This is shown in figure 4.3.1.1.19-1.

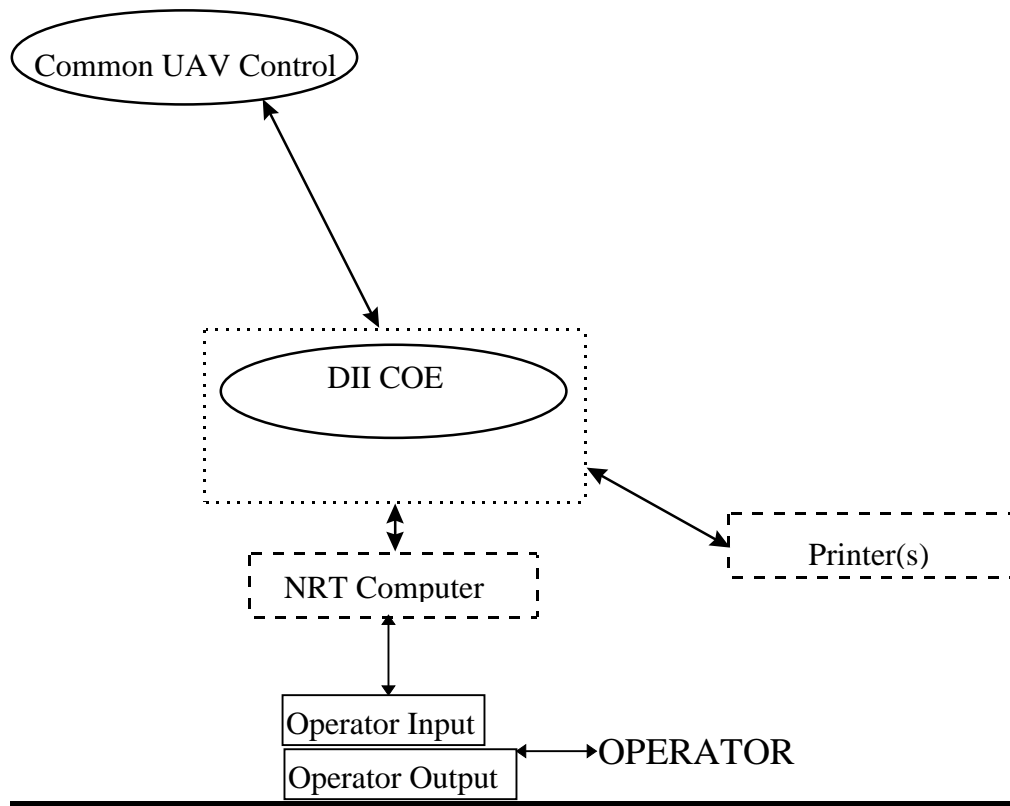


Figure 4.3.1.1.19-1 TCS Printer Control Data Flow Diagram

4.3.1.1.20 Voice Input/Output Communication

Voice input/output communication consists of two functions: TCS operator to TCS operator voice communications and TCS operator to non-TCS personnel via an integral TCS intercom or equipment provided to support TCS missions. This equipment may consist of MSE, SINCGARS, or other equipment. This is shown in figure 4.3.1.1.20-1.

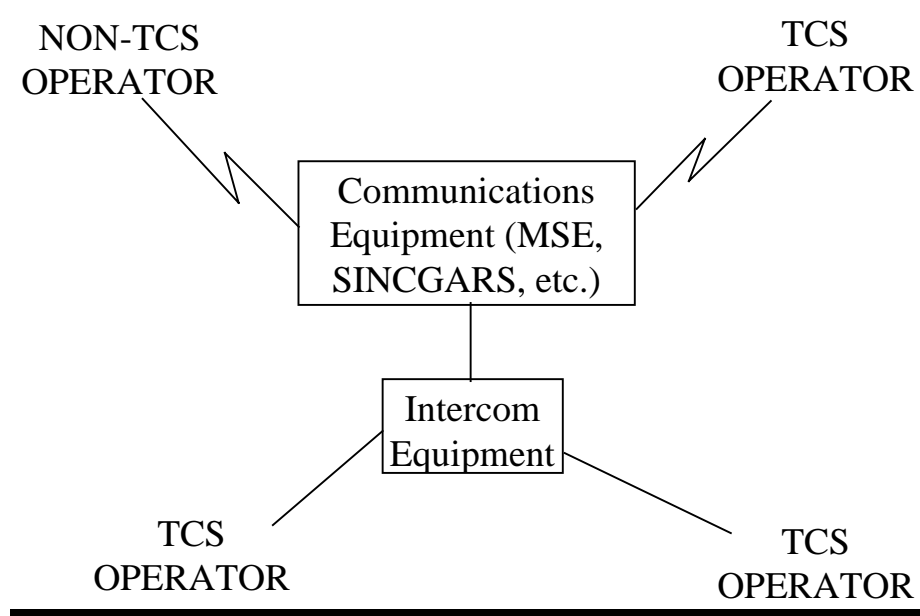


Figure 4.3.1.1.20-1 Voice Input/Output Flow Diagram

4.3.1.1.21 TCS to TCS Communication

The TCS to TCS communications shall consist of voice communications, messages, NITF 2.0 files, other TBD items via a LAN external to either TCS, the TCS intercom, MSE, SINCGARS, or other TBD communication equipment. (SSS375) [SSDD680] This is shown in figure 4.3.1.1.21-1.

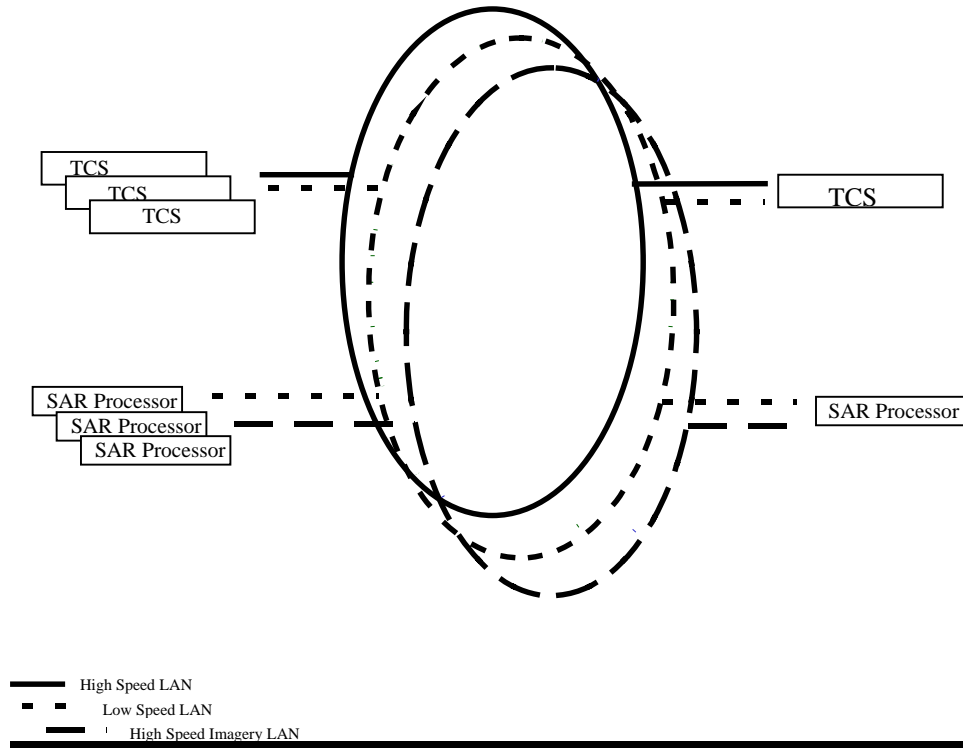


Figure 4.3.1.1.21-1 TCS to TCS Communication Data Flow Diagram

4.3.1.1.22 Analog Video Input/Output

The TCS shall accept video from the AV payload, another TCS, archives, VCRs, and other TBD sources. (SSS195) [SSDD681] The TCS shall provide video to CCTV, JMCIS, JSTARS, ETRAC, other TBD C4I systems, another TCS, the IPL, VCRs, and other TBD sources. (SSS194) [SSDD682] This is shown in figure 4.3.1.1.22-1.

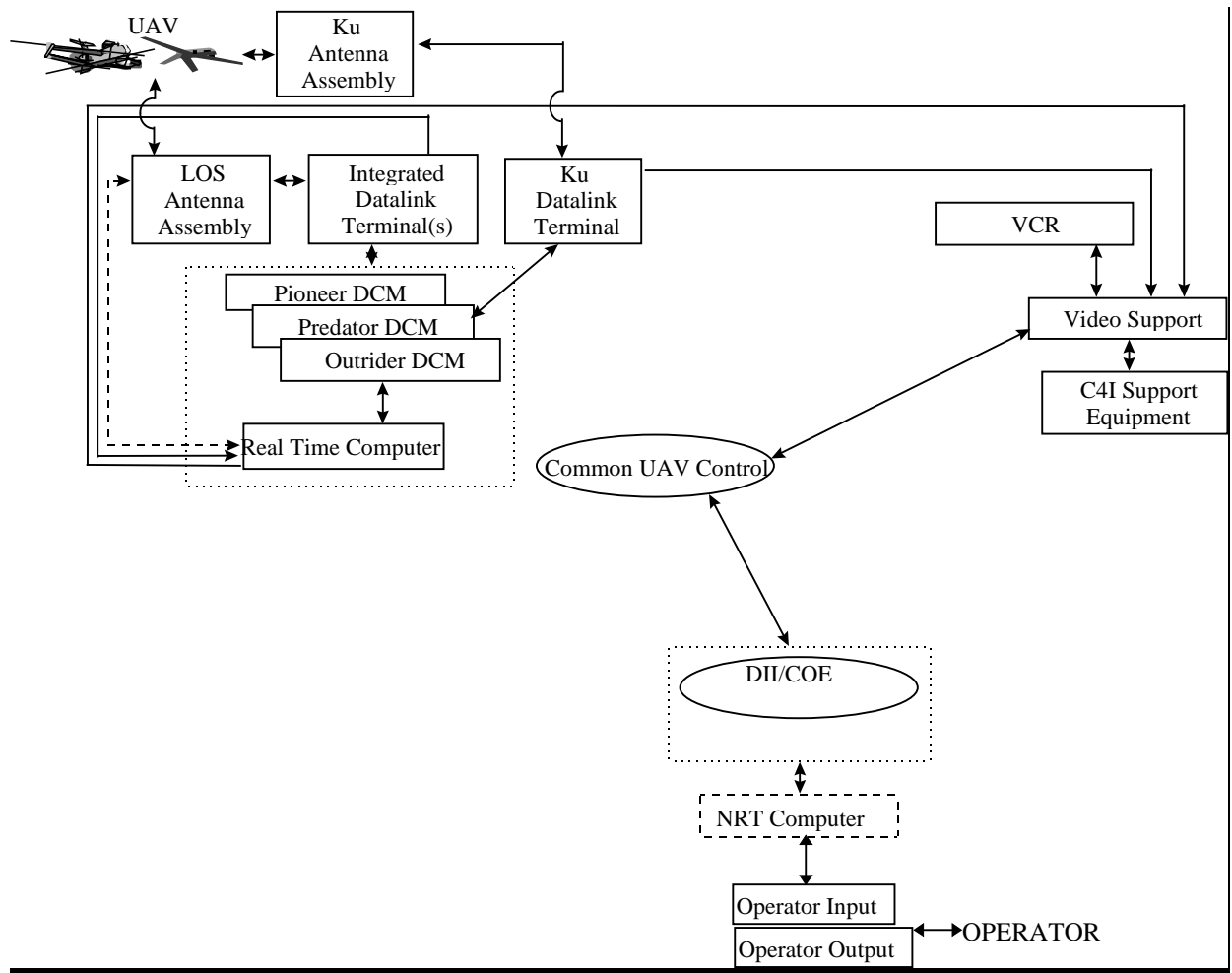


Figure 4.3.1.1.22-1 TCS Analog Video Input/Output Block Diagram

4.3.1.1.23 External LAN

The TCS exchanges messages and NITF 2.0 files with the following systems via an external LAN: ASAS, JMCIS, JSTARS, ETRAC, and other TBD C4I systems.

4.3.1.2 Training Mode Execution

The Training Mode shall provide the operator capability to train at any level of interaction regardless of the TCS hardware configuration. (SSS039) [SSDD683] All of the following CSCIs shall be capable of executing concurrently. (SSS039) [SSDD684]

1. Common UAV Control CSCI
2. TCS Mission Planner CSCI
3. C4I Interfaces CSCI
4. DII/COE CSCI
5. TCS Data Server CSCI

TCS training and training support shall include the processes, procedures, techniques, training devices and equipment to train civilian, active duty, and reserve military personnel to operate and support the TCS system. (SSS492) [SSDD685]

The TCS system shall provide, for the operator and maintainer, an embedded or add-on interactive training courseware with self-paced instruction, duplicating UAV flight performance characteristics, capabilities, and limitations. (SSS492) [SSDD686]

The Outrider TCS system shall be compatible with the U.S. Army IEW Tactical Proficiency Trainer as an objective. (SSS493) [SSDD687]

The interactive courseware training capability for TCS shall be developed during Phase I and introduced to the user during scheduled demonstrations and tests. (SSS494) [SSDD688]

The training capability for performance of TCS functions shall include primary mission (flight route/payload) planning, mission control and monitoring, imagery processing, tactical communications, AV control communications, and TCS system on-line diagnostics. (SSS495) [SSDD689]

The TCS shall provide the functional capability to train personnel in the operation of the TCS system, performance of TCS UAV functions, and on-line system troubleshooting. (SSS496) [SSDD690]

TCS system training shall include system architecture, component familiarization, and system startup, initialization, system recovery, on-line diagnostics, and shutdown. (SSS497) [SSDD691]

The TCS system shall not be required to support Training operations concurrent with the execution of an actual mission. (SSS499) [SSDD692]

The capability for the conduct of actual communications processing concurrently with Training operations shall be provided if and only if messages are identified as training messages. (SSS500) [SSDD693]

Training shall be adequate to maintain operator and maintainer skills and proficiencies. (SSS501) [SSDD694]

TCS shall record operator and maintainer actions for self assessment and performance enhancement. (SSS502) [SSDD695]

Operator and maintainer performance shall be measurable using parameters retrievable from the TCS to determine proficiency levels. (SSS503) [SSDD696]

In the Training Operations Mode the TCS shall support the following functions: (SSS039) [SSDD697]

1. Mission Planning
2. Mission Control and Monitoring
3. Payload Product Management
4. Target Coordinate Development
5. C4I Systems Interface

Functions under the Training Operations Mode shall operate concurrently without precluding or excluding any of the other functions, in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS040) [SSDD698]

4.3.1.3 Maintenance Mode Execution

In the Maintenance Operations Mode, the Common UAV Control CSCI shall support the following functions:

1. Conduct AV maintenance (SSS041)[SSDD699]
2. Conduct payload maintenance (SSS041)[SSDD700]
3. Conduct Datalink Terminal maintenance (SSS041)[SSDD701]
4. Conduct Operator Station and peripheral equipment maintenance (SSS041)[SSDD702]
5. Perform FD/L (SSS041)[SSDD703]
6. Perform Software Upgrades (SSS041)[SSDD704]
7. Perform Software Debug and Monitoring (SSS041)[SSDD705]

Functions, except for software upgrade and software debug, under the Maintenance Operations Mode shall operate concurrently without precluding or excluding any of the other functions in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS042) [SSDD706]

4.3.2 Configuration Item Priorities

Configuration Items associated with AV control and monitoring shall have the highest priority. (SSS037) [SSDD707] These include: Non-Real Time Computer HWCI, Ku Datalink Terminal HWCI, Real Time Computer HWCI, LOS Antenna Assembly HWCI, Ku Antenna Assembly HWCI, Data Control Module HWCI, Integrated Datalink Terminal HWCI, Operator Input HWCI, Operator Output HWCI, Manual Controls HWCI, Real Time Processes CSCI, TCS Data Server CSCI, Common UAV Control CSCI, and DII/COE CSCI. Configuration Items associated with Payload control and monitoring shall have second highest priority. (SSS037) [SSDD708] These include TBD. Configuration Items associated with sending and receiving C4I messages and analog video shall have the third highest priority. (SSS037) [SSDD709] These CIs include TBD. Configuration Items associated with storing Payload information shall have fourth highest priority. (SSS037) [SSDD710] These CIs include TBD. Configuration Items associated with voice communication shall have fifth highest priority. (SSS037) [SSDD711]

4.3.3 Interrupt Handling

Interrupt handling shall not impede mission performance. (SSS038) [SSDD712] Message alerts shall be presented in a manner so as not to interrupt mission performance. (SSS038) [SSDD713] Life threatening alerts shall be presented in accordance with MIL-STD-1472 with appropriate color coding and use of flashing where determined necessary. (SSS358) [SSDD714] Where interrupts occur because of subsystem or system failures, the corresponding system status shall be presented in the alert portion of the display screen. (SSS358) [SSDD715] System status shall be presented at the operator's discretion based on criticality and component priorities to the mission. (SSS250) [SSDD716] Common UAV Control CSCI shall handle all interrupts except for printer and C4I interrupts. (SSS038) [SSDD717] The printer interrupt(s) shall be handled by the DII/COE CSCI. (SSS224) [SSDD718] The C4I interrupts shall be handled by the C4I Interface CSCI. (SSS224) [SSDD719]

4.3.4 Exception Handling

The system shall enable the operator(s) to manually override the software diagnostics where mission performance or completion are critical. (SSS253) [SSDD720] The operator shall have command and control authority to perform dynamic retasking and decision control over mission, or system exceptions. (SSS067) [SSDD721]

The TCS shall provide the capability to override validation faults after the fault is acknowledged by the operator. (SSS540) [SSDD722]

4.4 Interface Design

The TCS design has both internal and external interfaces that are necessary for the proper operation of the system. The internal interfaces are between the various components (CSCIs and HWCIs) of the TCS. The external interfaces (inputs and outputs) are between the TCS and various support equipment as shown in Figure 3.1-1 TCS Inputs and Outputs.

4.4.1 TCS Interface Identification

4.4.1.1 TCS Component Interfaces

As shown in Figures 4.1-1 and 4.1-2, the TCS Component Architecture has the following types of component (CSCI and HWCI) interfaces: Software to Software, Software to Hardware, and Hardware to Hardware.

4.4.1.1.1 Software to Software Interfaces

The TCS shall have the following software to software interfaces: (SSS009) [SSDD723]

1. DII/COE to Common UAV Control
2. DII/COE to C4I Interfaces
3. DII/COE to TCS Mission Planning
4. TCS Data Server to Common UAV Control
5. TCS Data Server to TCS Mission Planner
6. Common UAV Control to C4I Interfaces

4.4.1.1.2 Software to Hardware Interfaces

The TCS shall have the following software to hardware interfaces: (SSS009) [SSDD724]

1. DII/COE to Internal Printer
2. DII/COE to External Printer
3. DII/COE to External Storage
4. DII/COE to Tactical Communication Interface Module (TCIM)
5. DII/COE to NRT Computer
6. C4I Interfaces to C4I Support Equipment
7. Common UAV Control to Video Support
8. Common UAV Control to VCR
9. Common UAV Control to SAR Processor
10. TCS Data Server to DCMs (AV Standard Interface)
11. TCS RTP to UCARS
12. TCS RTP to IBL

4.4.1.1.3 Hardware to Hardware Interfaces

The TCS shall have the following hardware to hardware interfaces: (SSS288) [SSDD725]

1. NRT Computer to C4I Support Equipment
2. NRT Computer to Printer
3. NRT Computer to Video Support
4. NRT Computer to VCR
5. Video Support to VCR
6. NRT Computer to SAR Processor
7. NRT Computer to Real Time Computer
8. Real Time Computer to DCMs
9. NRT Computer to Co-located NRT Computer(s)
10. DCMs to IDT
11. IDT to LOS Antenna Assembly
12. SAR Processor to Ku Datalink Terminal
13. Real Time Computer to LOS Antenna Assembly
14. DCM to Ku Antenna Assembly
15. SAR Processor to Digital Linear Tape Drive
16. NRT Computer to External Data Storage
17. Ku Datalink Terminal to Ku Antenna Assembly
18. IDT to Real Time Computer
19. Ku Datalink Terminal to Real Time Computer
20. Real Time Computer to Video Support
21. NRT Computer to Operator Output
22. NRT Computer to Operator Input

4.4.1.2 TCS External Interfaces

4.4.1.2.1 C4I Interfaces

The TCS shall interface with the following C4I systems: (SSS211) [SSDD726]

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)
3. Army Deep Operations Coordination System (ADOCS) *[TCS ORD required interface from TCS-to-ADOCS not to be implemented by direction of C4I IPT]*
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)

11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)
15. Service Mission Planners
16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS)

4.4.1.2.2 Power Interfaces

The TCS shall have the following power interfaces: (SSS344) [SSDD727]

1. UPS to Power
2. NRT Computer to UPS
3. Datalink Command Modules to UPS

4.4.1.2.3 Imagery System Interfaces

The TCS shall have the following imagery interfaces: (SSS209) [SSDD728]

1. NRT Computer to Image Product Library (IPL)
2. NRT Computer to Direct Dissemination Element (DDE)

4.4.1.2.4 Launch and Recovery Interfaces

The TCS shall have interfaces to the following launch and recovery systems (SSS289) [SSDD729]

1. Real Time Computer Assembly to UAV Common Automated Recovery System (UCARS)
2. Real Time Computer Assembly to Integrated Beacon Landing System (IBLS)

4.4.2 Interface Characteristics

4.4.2.1 TCS Component Interface Characteristics

4.4.2.1.1 Software to Software Interface Characteristics

All TCS software interface characteristics shall be defined and specified by the TCS Software Design Document, TCS TBD and the TCS Data Server Interface Design Description, TCS TBD. (SSS430)[SSDD730]

4.4.2.1.2 Software to Hardware Interfaces Characteristics

4.4.2.1.2.1 DII/COE to Internal Printer

An interface shall exist so that the DII/COE CSCI can pass information to an internal printer. (SSS314) [SSDD731]

This interface shall consist of printer commands from the DII/COE to the printer, and status information from the printer to DII/COE. (SSS314) [SSDD732]

This interface is not flight critical, nor mission critical and is designated as a low priority.

The interface characteristics for the internal printer shall be defined and specified by the TCS to Printer IDD, TCS TBD. (SSS337) [SSDD733]

4.4.2.1.2.2 DII/COE to External Printer

An interface shall exist so that the DII/COE CSCI can pass information to an external printer. (SSS314) [SSDD734]

This interface shall consist of printer commands from the DII/COE to the printer, and status information from the printer to DII/COE. (SSS314) [SSDD735]

This interface is not flight critical, nor mission critical and is designated as a low priority.

The interface characteristics for the external printer shall be defined and specified by the TCS to Printer IDD, TCS TBD. (SSS314) [SSDD736]

4.4.2.1.2.3 DII/COE to External Storage

An interface shall exist so that the DII/COE CSCI can pass digital data to an external storage device. (SSS317) [SSDD737]

This interface shall consist of the transmission of storage and retrieval commands from the DII/COE CSCI to the External Storage HWCI, and status information from the External Storage HWCI to the DII/COE CSCI. (SSS317) [SSDD738]

This interface is not flight critical, nor mission critical and is designated as a low priority.

The interface characteristics for the external storage will be defined and specified by the TCS to External Storage IDD, TCS TBD

4.4.2.1.2.4 DII/COE to NRT Computer

An interface shall exist between the DII/COE CSCI and the NRT Computer HWCI. (SSS211) [SSDD739]

This interface is flight critical and mission critical and is designated as a high priority interface.

The DII/COE CSCI and the NRT Computer HWCI interface shall be defined and specified by the associated documentation. (SSS211) [SSDD740]

4.4.2.1.2.5 C4I Interfaces to C4I Support Equipment

The C4I Interfaces CSCI to C4I Support Equipment HWCI interface shall pass information to and from standard DoD tactical (VHF, UHF, and UHF/VHF) radios, Mobile Subscriber Equipment, and military and commercial satellite communications equipment. (SSS285) [SSDD741]

The C4I Interfaces CSCI to C4I Support Equipment HWCI Interface shall pass information to and from external mission tasking systems (e.g., receive tasking orders, coordinate mission certification). (SSS286) [SSDD742]

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The C4I Interfaces CSCI to C4I Support Equipment HWCI interface shall be defined and specified by the TCS to C4I Support Equipment Interface Design Description, TCS TBD. (SSS209) [SSDD743]

4.4.2.1.2.6 Common UAV Control to Video Support

An interface shall exist between the Common UAV Control CSCI to Video Support HWCI. (SSS219) [SSDD744]

This interface shall consist of the transmission of video associated commands from the Common UAV Control CSCI to Video Support HWCI, and status and analog imagery information from the Video Support HWCI to Common UAV Control CSCI. (SSS219) [SSDD745]

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The Common UAV Control CSCI to Video Support HWCI interface shall be defined and specified by the TCS Analog Imagery Interface Design Description, TCS TBD. (SSS226) [SSDD746]

4.4.2.1.2.7 Common UAV Control to VCR

A Common UAV Control CSCI to VCR HWCI interface shall exist such that commands from the Common UAV Control CSCI to the VCR HWCI and status data can be routed from the VCR HWCI to the Common UAV Control CSCI. (SSS335) [SSDD747]

This interface is not flight critical and is not mission critical and is designated as a low priority interface.

The Common UAV Control CSCI to Video Support HWCI interface shall be defined and specified by the TCS to VCR Interface Design Description, TCS TBD. (SSS004) [SSDD748]

4.4.2.1.2.8 SAR to SAR Processor

The SAR CSCI shall have an interface with the SAR Processor HWCI. (SSS330) [SSDD749]

This interface shall consist of the transmission of standard communications that occur between software and its associated hardware platform. (SSS330) [SSDD750]

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The SAR CSCI to SAR Processor HWCI interface shall be defined and specified by the associated

manufacture's design documentation. (SSS426) [SSDD751]

4.4.2.1.2.9 TCS Data Server to DCMs (AV Standard Interface)

The TCS Data Server CSCI shall provide the system functionality necessary to interface with the AV specific DCM HWCI. (SSS312) [SSDD752]

The TCS Data Server CSCI to DCM HWCI interface shall provide the proper data format to ensure communications with the selected AV. (SSS322) [SSDD753]

TCS Data Server CSCI to DCM HWCI interface shall allow for addition of future AVs and will provide the generic architecture to ensure interoperability. (SSS323) [SSDD754]

The uplink and downlink information passed between the TCS and the AV over the TCS Data Server CSCI to DCM HWCI interface shall be in accordance with the associated AV documentation. (SSS324) [SSDD755]

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS Data Server CSCI to DCM HWCI interface shall be defined and specified by the TCS AVSI Interface Design Description, TCS TBD. (SSS004) [SSDD756]

4.4.2.1.2.10 TCS RTP to UCARS

The TCS RTP CSCI shall interface with the UCARS HWCI (SSS137) [SSDD757]

This interface shall consist of the transmission of AV recovery information and UCARS status from the UCARS HWCI to the RTP CSCI, and operational commands from the RTP CSCI to the UCARS HWCI. (SSS137) [SSDD758]

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS RTP CSCI to UCARS HWCI interface shall be defined and specified by the TCS UCARS Interface Design Description, TCS TBD. (SSS004) [SSDD759]

4.4.2.1.2.11 TCS RTP to IBLS

The TCS RTP CSCI shall interface with the IBLS HWCI. (SSS136) [SSDD760]

This interface shall consist of the transmission of AV recovery information and IBLS status from the IBLS HWCI to the RTP CSCI, and operational commands from the RTP CSCI to the IBLS HWCI. (SSS136) [SSDD761]

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS RTP CSCI to IBLS HWCI interface shall be defined and specified by the TCS IBLS Interface Design Description, TCS TBD. (SSS004) [SSDD762]

4.4.2.1.2.12 RTP to Real Time Computer

The RTP CSCI shall have an interface with the Real Time Computer Assembly HWCI. (SSS401) [SSDD763]

This interface shall consist of the transmission of standard communications that occur between

software and its associated hardware platform. (SSS401) [SSDD764]

This interface is flight critical and mission critical and is designated as a high priority interface.

The RTP CSCI to Real Time Computer Assembly HWCI interface shall be defined and specified by the associated manufacture's design documentation. (SSS004) [SSDD765]

4.4.2.1.2.13 DII/COE to TCIM

The DII/COE to TCIM interface shall exist so that the DII/COE CCSCI can pass messages to SSINCGARS and MSE. (SSS214) [SSDD766]

The DII/COE to TCIM interface shall consist of the tcomm_read and tcomm_write function calls used to pass message headers containing message data between the TCS and the DII/COE Comm server through system defined buffers. (SSS214) [SSDD767]

The DII/COE to TCIM interface is not flight critical nor mission critical and is designated as a low priority.

The DII/COE to TCIM interface characteristics for the external storage shall be defined and specified by the TCS to TCIM IDD TCS 225. (SSS214) [SSDD768]

4.4.2.1.3 Hardware to Hardware Interfaces Characteristics

4.4.2.1.3.1 NRT Computer to C4I Support Equipment

The NRT Computer shall interface to the required C4I Support Equipment in order to provide the functionality to send tactical communication messages. (SSS209) [SSDD769]

This interface shall consist of the receipt and transmittal of C4I communication messages from the NRT Computer to the required C4I Support Equipment. (SSS211) [SSDD770]

The NRT Computer to C4I Support Equipment interface is not a flight critical interface but is crucial to the mission and is designated a medium priority interface.

This interface shall be defined and specified in TBD. (SSS004) [SSDD771]

4.4.2.1.3.2 NRT Computer to Printer

A physical interface shall exist between the NRT Computer HWCI and the Internal Printer HWCI. (SSS314) [SSDD772]

The NRT Computer HWCI shall have ports for outputting data and imagery to an Internal Printer HWCI. (SSS337) [SSDD773]

The NRT Computer to Internal Printer is not flight critical nor mission critical and is designated as a low priority interface.

The interface characteristics for the internal printer shall be defined and specified by the TCS to Printer IDD, TCS TBD. (SSS004) [SSDD774]

4.4.2.1.3.3 NRT Computer to Video Support

The NRT Computer shall provide an interface to the Video Support Equipment to include as a minimum a video switch. (SSS327) [SSDD775]

The interface shall consist of digital control information from the NRT Computer to the Video Support equipment (video switch), information from the Video Support equipment to the NRT Computer, the transmittal of raw video (RS-170A) from the Video Support equipment to the TCS, transmittal of video with as well as without overlay, and the transmittal of annotated video from the NRT Computer to the Video Support equipment. (SSS327) [SSDD776]

The interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The interface characteristics for the video support shall be defined and specified by the TCS to Video Support IDD, TCS TBD. (SSS...) [SSDD...]

4.4.2.1.3.4 NRT Computer to VCR

The NRT Computer shall provide an interface to a VCR. (SSS327) [SSDD777]

The interface shall consist of digital control information from the NRT Computer to the VCR and status information from the VCR to the NRT Computer. (SSS327) [SSDD778]

This interface is not flight critical, but is mission crucial and is designated as a medium priority interface.

The interface characteristics for the VCR shall be defined and specified by the TCS to VCR Control IDD, TCS TBD. (SSS004) [SSDD779]

4.4.2.1.3.5 Video Support to VCR

The Video Support shall have an interface to a VCR. (SSS327) [SSDD780]

This interface shall consist of video (RS-170A) storage to the VCR and video retrieval from the VCR. (SSS336) [SSDD781]

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The Video Support to VCR interface shall be defined and specified in the TCS to Analog Imagery Interface Design Description, TCS TBD. (SSS004) [SSDD1005]

4.4.2.1.3.6 NRT Computer to SAR Processor

The NRT Computer shall interface with the SAR Processor. (SSS330) [SSDD782]

This interface shall consist of SAR information receipt (imagery and telemetry) to the NRT Computer. (SSS330) [SSDD783]

This interface is not flight critical but is mission crucial and is designated a medium priority interface.

The NRT Computer to SAR Processor interface shall be defined and specified in the TCS to SAR

Processor IDD, TCS TBD. (SSS004) [SSDD1006]

4.4.2.1.3.7 NRT Computer to Real Time Computer Interface

The NRT Computer shall provide an interface to the Real Time Computer. (SSS326) [SSDD784]

This interface is flight critical and mission crucial and is designated as a high priority interface.

This interface shall be defined and specified by TBD. (SSS004) [SSDD785]

4.4.2.1.3.8 Real Time Computer to Datalink Command Modules

The NRT Computer HWCI shall provide the system functionality necessary to interface with the DCMs. (SSS312) [SSDD786]

This interface is a flight critical and mission crucial interface and is designated as a high priority interface.

The TCS to DCM interfaces shall be defined and specified by the TCS Datalink Control Module (DCM) Hardware development Specification, TCS TBD and the TCS to AV Standard Interface Design Description, TCS 229. (SSS312) [SSDD787]

4.4.2.1.3.9 NRT Computer to Co-located NRT Computer(s)

The NRT Computer shall provide the functionality to interface with a co-located NRT Computer to provide a distributed processing capability. (SSS328) [SSDD788]

This interface is potentially a flight critical and mission crucial interface (depending on the operational situation) and is designated as a high priority interface.

This interface shall be defined and specified by TBD. (SSS004) [SSDD789]

4.4.2.1.3.10 DCMs to IDT

The DCM shall provide the functionality to interface with the IDT. (SSS327) [SSDD790]

This interface shall consist of the uplink of AV and payload commands that are generated by TCS, and the downlink of all AV and payload data from the IDT to the DCM. (SSS313) [SSDD791]

This interface is flight critical and mission crucial and is designated as a high priority interface.

This interface shall be defined and specified by TCS Datalink Control Module Hardware Development Specification, TCS TBD; the TCS DCM Interface Design Description, TCS TBD; and the TCS IDT Interface Design Description, TCS TBD. (SSS004) [SSDD792]

4.4.2.1.3.11 IDT to LOS Antenna Assembly

The IDT shall provide an interface to the LOS Antenna Assembly. (SSS313) [SSDD793]

This interface shall consist of the transmission of uplink information from the IDT to the LOS Antenna Assembly, and the receipt of downlink information from the LOS Antenna Assembly to the IDT. (SSS312) [SSDD794]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The IDT to LOS Antenna Assembly interface shall be define and specified in the TCS IDT Interface Design Description, TCS TBD. (SSS004) [SSDD795]

4.4.2.1.3.12 SAR Processor to Ku Antenna Assembly

The SAR Processor shall provide an interface to the Ku Antenna Assembly. (SSS330) [SSDD796]

This interface shall consist of the transmission of SAR Imagery from the Ku Antenna Assembly to the SAR Processor. (SSS330) [SSDD797]

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The SAR Processor to Ku Antenna Assembly interface is defined and specified by the (TBD associated Northrop Grumman documentation).

4.4.2.1.3.13 Real Time Computer Assembly to LOS Antenna Assembly

The Real Time Computer Assembly shall provide an interface to the LOS Antenna Assembly. (SSS313) [SSDD798]

This interface shall consist of the transmission of antenna pointing commands from the Real Time Computer Assembly to the LOS Antenna Assembly. (SSS312) [SSDD799]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The Real Time Computer Assembly to LOS Antenna Assembly interface shall be defined and specified by the TCS to C-Band LOS Antenna Control Interface Design Description, TCS TBD. (SSS313) [SSDD800]

4.4.2.1.3.14 DCM to Ku Antenna Assembly

The DCM shall provide an interface to the Ku Antenna Assembly. (SSS313) [SSDD801]

This interface shall consist of the transmission of command and control information from the DCM to the Ku Antenna Assembly and the transmission of status information from the Ku Antenna Assembly to the DCM. Currently this interface only applies to the Predator DCM. (SSS313) [SSDD802]

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The DCM to Ku Antenna Assembly interface shall be defined and specified in the TCS SATCOM Interface Design Description, TCS TBD. (SSS004) [SSDD803]

4.4.2.1.3.15 SAR Processor to Digital Linear Tape Drive

The SAR Processor shall have an interface to a Digital Linear Tape Drive. (SSS330) [SSDD804]

This interface shall consist of the storage of SAR data from the SAR Processor to the Digital Linear Tape Drive and retrieval of SAR data from the Digital Linear Tape Drive to the SAR Processor. (SSS317) [SSDD805]

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

This SAR Processor to Digital Linear Tape Drive interface shall be defined and specified in the TCS to SAR Processor Interface Design Description, TCS TBD. (SSS004) [SSDD806]

4.4.2.1.3.16 NRT Computer to External Data Storage

The NRT Computer shall provide and interface to access external data storage devices. (SSS317) [SSDD807]

This interface shall consist of the storage of data to the external storage device from the NRT Computer, and the retrieval of stored data from the external data storage devices by the NRT Computer. (SSS318) [SSDD808]

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

This interface shall be defined and specified by the TCS to External Data Storage Interface Design Description, TCS TBD. (SSS004) [SSDD809]

4.4.2.1.3.17 Ku Datalink Terminal to Ku Antenna Assembly

The Ku Datalink Terminal shall interface with the Ku Antenna Assembly. (SSS164) [SSDD810]

This interface shall consist of the transmission of uplink commands from the Ku Datalink Terminal to the Ku Antenna Assembly, and the transmission of downlink information from the Ku Antenna Assembly to the Ku Datalink Terminal. (SSS164) [SSDD811]

This interface is flight critical and mission critical and is designated as a high priority interface.

The Ku Datalink Terminal to Ku Antenna Assembly interface shall be defined and specified in the TCS Ku Band Datalink Terminal Interface Design Description, TCS TBD and the TCS Ku Antenna Control Interface Design Description, TCS TBD (SSS004) [SSDD812]

4.4.2.1.3.18 IDT to Real Time Computer

TBD

4.4.2.1.3.19 Ku Datalink Terminal to Real Time Computer

TBD

4.4.2.1.3.20 Real Time Computer to Video Support

TBD

4.4.2.1.3.21 NRT Computer to Operator Output

TBD

4.4.2.1.3.22 NRT Computer to Operator Input

TBD

4.4.2.2 External Interface Characteristics

The TCS shall have external interfaces to C4I systems, power, imagery systems, and launch and recovery systems. (SSS209) [SSDD813]

4.4.2.2.1 TCS to C4I Interface Characteristics

4.4.2.2.1.1 Automatic Target Hand-off Systems

The TCS shall have an interface with the Automatic Target Hand-off Systems (ATHS) in accordance with document TCS 208, Tactical Control System to Automatic Target Hand-off Systems IDD. (SSS304) [SSDD814]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.2 Advanced Field Artillery Tactical Data Systems

The TCS shall have an interface with the AFATDS in accordance with document TCS 200, Tactical Control System to Advanced Field Artillery Tactical Data Systems IDD. (SSS295) [SSDD815]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data between the two systems. The formats supported are: USMTF messages, TACFIRE messages, and still digital imagery in the NITF 2.0 format.

This interface medium can be a digital LAN, SINCGARS, MSE, or TACFIRE communications.

4.4.2.2.1.3 Army Deep Operations Coordination System

The TCS shall have an interface with ADOCS in accordance with document TCS TBD, Tactical Control System to ADOCS IDD. (SSS296) [SSDD816] *[TCS ORD required interface from TCS-to-ADOCS not to be implemented by direction of C4I IPT]*

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.4 All Source Analysis System

The TCS shall have an interface with the ASAS in accordance with document TCS 201, Tactical Control System to All Source Analysis System Interface Design Description (IDD). (SSS291) [SSDD817]

The interface is not flight critical but is mission critical and is designated a medium priority

interface.

This interface supports the exchange of non-real-time formatted data between the two systems. The formats supported are: USMTF messages, still digital imagery in the NITF 2.0 format, and Sunraster imagery.

This interface medium can be either a digital LAN and/or MSE, or communications.

4.4.2.2.1.5 Intelligence Analysis System

The TCS shall have an interface with IAS in accordance with document TCS 206, Tactical Control System to Intelligence Analysis System Interface Design Description (IDD).(SSS303) [SSDD818]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.6 Joint Surveillance Target Attack Radar System Ground Station Module/Common Ground Station

The TCS shall have an interface with the JSTARS Advanced Imagery Common Ground Station (AICGS) in accordance with document TCS 209, Tactical Control System to Joint Surveillance Target Attack Radar System Advanced Imagery Common Ground Station Interface Design Description (IDD). (SSS292) [SSDD819]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The formats supported are: USMTF messages, mission and flight data messages, area of interest messages, still digital imagery and support data in the NITF 2.0 format, and voice via LAN. The real-time analog imagery is NTSC video.

This interface media are a digital local area network for the non-real-time information and a coaxial cable for the NTSC video.

4.4.2.2.1.7 Joint Maritime command Information System

The TCS shall have an interface with the Joint Maritime Command Information System (JMCIS) in accordance with document TCS 214, Tactical Control System to Joint Maritime Command Information System Interface Design Description (IDD). (SSS293) [SSDD820]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The non-real-time formats supported are: USMTF messages, OTH-T GOLD messages, TIFF imagery, Sunraster imagery, and still digital imagery and support data in the NITF 2.0 format. The real time analog imagery is in NTSC video format.

This interface media are a digital local area network for the non-real-time information and a coaxial cable or Fiber-Distributed Data Interface (FDDI) for the real-time imagery.

4.4.2.2.1.8 Closed Circuit Television

The TCS shall have an interface with Closed Circuit Television (CCTV) Systems in accordance with document TCS 205, Tactical Control System to Closed Circuit Television System Interface Design Description (IDD). (SSS298) [SSDD821]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of real-time NTSC analog video imagery between the two systems.

This interface medium is a standard video coaxial cable or FDDI for the real time analog imagery.

4.4.2.2.1.9 Advanced Tomahawk Weapons Control Station

The TCS shall have an interface with ATWCS in accordance with document TCS 203, Tactical Control System to Advanced Tomahawk Weapons Control Station Interface Design Description (IDD). (SSS305) [SSDD822]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.10 Joint Deployable Intelligence Support System

The TCS shall have an interface with the JDISS in accordance with document TCS 212, Tactical Control System to Joint Deployable Intelligence Support System Interface Design Description (IDD). (SSS301) [SSDD823]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.11 Trojan Special Purpose Integrated Remote Intelligence Terminal II

The TCS shall have an interface with the Trojan SPIRIT II in accordance with document TCS 213, Tactical Control System to Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II Interface Design Description (IDD). (SSS306) [SSDD824]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.12 Joint Service Imagery Processing System

The TCS shall have an interface with the Joint Service Imagery Processing System - Air Force (JSIPS-AF) in accordance with document TCS 211, Tactical Control System to Joint Service Imagery Processing System – Air Force IDD. (SSS294) [SSDD825]

The TCS shall have an interface with the Joint Service Imagery Processing System (JSIPS)-Navy in accordance with document TCS 210, Tactical Control System to Joint Service Imagery Processing System – Navy IDD. (SSS294) [SSDD826]

The interface is not flight critical but is mission critical and is designated a medium priority

interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The non-real-time format supported is still digital imagery and support data in the NITF 2.0 format. The real-time imagery is NTSC video.

This interface media are a digital local area network for the non-real-time information and standard video coaxial cable or FDDI for the real-time analog imagery.

4.4.2.2.1.13 JSIPS Tactical Exploitation Group

The TCS shall have an interface with the Joint Service Imagery Processing System Tactical Exploitation Group (JSIPS TEG) in accordance with document TCS 207, Tactical Control System to Joint Service Imagery Processing System Tactical Exploitation Group IDD. (SSS311) [SSDD827]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.14 Tactical Exploitation System

The TCS shall have an interface with the JSIPS TES in accordance with document TCS TBD, Tactical Control System to Joint Service Imagery Processing System Tactical Exploitation System IDD. (SSS302) [SSDD828]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.15 Service Mission Planners

The TCS shall have an interface with the AFMSS in accordance with document TCS 220, Tactical Control System to Air Force Mission Support System IDD. (SSS299) [SSDD829]

The TCS shall have an interface with the AMPS in accordance with document TCS TBD, Tactical Control System to Army Mission Planning System IDD. (SSS299) [SSDD830]

The TCS shall have an interface with the TAMPS in accordance with document TCS 219, Tactical Control System to Tactical Aircraft Mission Planning System IDD. (SSS299) [SSDD831]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.16 Theater Battle Management Core System

The TCS shall have an interface with the TBMCS in accordance with document TCS 221, Tactical Control System Theater Battle Management Core System IDD. (SSS307) [SSDD832]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.17 Guardrail Common Sensor Aerial Common Sensor Integrated Processing Facility

The TCS shall have an interface with the GCS ACS IPF in accordance with document TCS 215, Tactical Control System to Guardrail Common Sensor Aerial Common Sensor Integrated Processing Facility IDD. (SSS300) [SSDD833]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.18 Modernized Imagery Exploitation System

The TCS shall have an interface with the MIES in accordance with document TCS 216, Tactical Control System to Modernized Imagery Exploitation System IDD. (SSS308) [SSDD834]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.19 Enhanced Tactical Radar Correlator

The TCS shall have an interface with the ETRAC in accordance with document TCS 218, Tactical Control System to Enhanced Tactical Radar Correlator IDD. (SSS309) [SSDD835]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.20 Contingency Airborne Reconnaissance System

The TCS shall have an interface with the CARS in accordance with document TCS 217, Tactical Control System to Contingency Airborne Reconnaissance System IDD. (SSS297) [SSDD836]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.1.21 Common Operational Modeling, Planning, and Simulation System

The TCS shall have an interface with the COMPASS in accordance with document TCS 222, Tactical Control System to Common Operational Modeling, Planning, and Simulation System IDD. (SSS310) [SSDD837]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.4.2.2.2 Power Interface Characteristic

4.4.2.2.2.1 UPS to External Power Interface Characteristics

The UPS shall have an interface with external power sources. (SSS344) [SSDD838]

This interface shall consist of the transmission of 110/220 $\pm 10\%$ volts, 50/60 $\pm 5\%$ Hertz power. (SSS385) [SSDD839]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS Power Interfaces shall be as defined and specified in the TCS to External Power Interface Design Description, TCS XXX. (SSS320) [SSDD840]

4.4.2.2.2.2 NRT Computer to UPS Interface Characteristics

The NRT Computer shall have an interface to an uninterruptible power supply. (SSS344) [SSDD841]

This interface shall consist of the transmission of power from the UPS to the NRT Computer in order to provide power conditioning and to allow safe and orderly shutdown of the NRT Computer. Safe and orderly shutdown includes consideration of the AV if it is in flight. (SSS344) [SSDD842]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The NRT Computer to UPS Interfaces shall be defined and specified in the TCS to UPS, TCS TBD IDD. (SSS344) [SSDD843]

4.4.2.2.3 Datalink Command Modules to UPS Interface Characteristics

The DCM HWCIs shall have an interface to an uninterruptible power supply. (SSS344) [SSDD844]

This interface shall consist of the transmission of power from the UPS to the DCMs in order to allow safe and orderly shutdown of the DCMs. Safe and orderly shutdown shall include consideration of the AV if it is in flight. (SSS344) [SSDD845]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS UPS Interfaces shall be defined and specified in the TCS to UPS IDD, TCS XXX Interface Design Description. (SSS344) [SSDD846]

4.4.2.2.3 Image System Interface Characteristics

The image system interface characteristics are contained in the image product library interface characteristics and the direct dissemination element interface characteristics as described in the following sections.

4.4.2.2.3.1 Image Product Library Interface Characteristics

The TCS shall provide an interface to an IPL. (SSS209) [SSDD847]

This interface shall consist of the transmission of imagery data between the TCS and the IPL. (SSS210) [SSDD848]

This interface is not flight critical, nor mission crucial and is designated as a low priority interface.

The interface between the TCS and the IPL shall be defined in the TCS to Image Product Library IDD, TCS TBD. (SSS004) [SSDD849]

4.4.2.2.3.2 Direct Dissemination Element Interface Characteristics

The TCS shall provide and interface to a Direct Dissemination Element (DDE). (SSS209) [SSDD850]

This interface shall consist of the transfer of HAE Imagery data from the DDE to the TCS. (SSS210) [SSDD851]

This interface is not flight critical, nor mission crucial and is designated as a low priority interface.

This TCS to DDE interface shall be defined and specified by the TCS to Direct Dissemination Element IDD, TCS TBD. (SSS429) [SSDD852]

4.4.2.2.4 Launch and Recovery Interfaces

4.4.2.2.4.1 UAV Common Automated Recovery System

The TCS shall provide an interface to UCARS. (SSS137) [SSDD853]

This interface shall consist of the transmission of AV recovery commands from UCARS to TCS and the transmission of AV status from TCS to UCARS. (SSS137) [SSDD854]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS to UCARS interface shall be defined and specified in the TCS to UCARS IDD, TCS TBD. (SSS429) [SSDD855]

4.4.2.2.4.2 Integrated Beacon Landing System

The TCS shall provide an interface to IBLS. (SSS136) [SSDD856]

This interface shall consist of the transmission of AV recovery commands from IBLS to TCS and the transmission of AV status from TCS to IBLS. (SSS136) [SSDD857]

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS to IBLS interface shall be defined and specified in the TCS to IBLS IDD, TCS TBD. (SSS429) [SSDD858]

4.5 Design and Construction

The TCS shall be designed such that no single software failure results in an unsafe command being transmitted to the air vehicle. (SSS353)[SSDD859]

The TCS shall be designed such that no single hardware failure results in an unsafe command being transmitted to the air vehicle. (SSS353)[SSDD860]

The TCS shall be designed to minimize the number and frequency of required preventive maintenance actions based on performance requirements and lowest life cycle costs. (SSS412) [SSDD861]

To the extent possible, the TCS design shall minimize the requirement for specially trained maintenance personnel. (SSS412) [SSDD862]

In addition to Fault Detection/Location (FD/L), TCS design shall improve system availability by the effective selection and incorporation of Built In Test Equipment (BITE). (SSS412) [SSDD863]

The TCS shall be designed in a manner that will allow for removal and replacement of replaceable units without soldering and unsoldering. (SSS412) [SSDD864]

During Phase 1, control techniques to minimize electromagnetic interference, emanation, and susceptibility shall be used in the design of TCS equipment. (SSS432) [SSDD865] This control will be inherent in the design of the TCS and the electrical and electronic equipment components and assemblies thereof.

There shall be neither unacceptable response nor malfunction of any TCS and associated equipment due to EMI produced by any as well as all of the TCS and equipment associated with the TCS. (SSS434) [SSDD866]

The environmental support required by the TCS shall be the same as that required for the respective UAV System. (SSS514) [SSDD1007]

The TCS shall be compatible with the external electromagnetic environment that is typical of the service specific environment in the TCS will be operated. (SSS435) [SSDD867] The specific electromagnetic environment values will be determined during Phase I of the TCS development.

The TCS design shall ensure that personnel, fuel, and ordinance are not exposed to adverse electromagnetic radiation as a result of operating the TCS. (SSS436) [SSDD868] The specific radiation hazard (RADHAZ) and HERO values will be determined during Phase I of the TCS development.

The TCS shall be designed to protect its communication and data links against enemy Electronic Warfare (EW) threats, physical anti-radiation weaponry and physical destruction. (SSS366)[SSDD869]

Interface error handling shall be realized and controlled by the appropriate interface protocol method of the interface. (SSS234)[SSDD870]

The TCS shall provide the capability to simultaneously view imagery as well as data from more than one payload, when applicable. (SSS537)[SSDD871]

The response time for the TCS shall be equal to or less than the response times of the Predator and Outrider GCSs. (SSS008)[SSDD872]

The TCS shall have an objective capability to be integrated and operated from tactical and command and control aircraft. (SSS531) [SSDD1008]

The total, fully usable, addressable, physically present program instruction memory and data storage memory for each processor shall have at least 50% unused memory during the Normal Operations Mode over any 10 second period. (SSS414) [SSDD873]

The processing speed of each processor shall be such that at least 50% of the throughput of each processor remains unused over all 10 second periods and at least 20% of the throughput of each processor remains unused over one second periods regardless of the system function performed. (SSS415) [SSDD874]

The I/O channel reserve capability for each processor shall have at least a 50% reserve, addressable and usable, I/O channel capacity over any 10 second period. (SSS416) [SSDD875]

4.6 Reliability

The TCS shall minimize the contribution to degradation of TCS equipment reliability as a consequence of performing either preventive as well as corrective maintenance. (SSS412) [SSDD876]

The TCS equipment shall achieve an availability (A_o), as defined by the below equation. (SSS413) [SSDD877]

$$A_o = (OT + ST) / (OT + ST + TPM + TCM + TALDT)$$

where: OT denotes Operate Time
 ST denotes Standby Time
 TPM denotes Total Preventative Maintenance
 TCM denotes Total Corrective Maintenance
 TALDT denotes Total Administrative and Logistic Downtime

The threshold A_o for the TCS shall be greater than or equal to 90% in order to maintain a continuous 24 hour presence (SSS413) [SSDD035], with an objective A_o of 95%. (SSS413) [SSDD878]

The A_0 , MTBF and MTTR for the various HWCIs of the TCS shall be equal to or less than the values shown in table 4.6-1. (SSS413) [SSDD879]

Table 4.6-1 HWC I Reliability Values

| HWC I | A_0 | MTBF | MTTR |
|--------------------------------------|-------------------------|-------------|-------------|
| Datalink Terminal | TBD | TBD | TBD |
| Antenna Assembly | TBD | TBD | TBD |
| Datalink Control Module | TBD | TBD | TBD |
| Integrity Beacon Landing System | TBD | TBD | TBD |
| UAV Common Automated Recovery System | TBD | TBD | TBD |
| Real Time computer | TBD | TBD | TBD |
| Manual Control | TBD | TBD | TBD |
| SAR Processor | TBD | TBD | TBD |
| Digital Linear Tape Drive | TBD | TBD | TBD |
| Redundant Array of Inexpensive Disks | TBD | TBD | TBD |
| Link Manager Assembly | TBD | TBD | TBD |
| Non-Real Time Computer | TBD | TBD | TBD |
| Video Support | TBD | TBD | TBD |
| Operator Output | TBD | TBD | TBD |
| Operator Input | TBD | TBD | TBD |
| External Storage | TBD | TBD | TBD |
| Printer | TBD | TBD | TBD |
| Intercom Equipment | TBD | TBD | TBD |
| C4I Support Equipment | TBD | TBD | TBD |
| Communication Equipment | TBD | TBD | TBD |
| Uninterruptible Power Supply | TBD | TBD | TBD |
| Power Distribution | TBD | TBD | TBD |

The TCS shall achieve a threshold system reliability (Mean Time Between Failures MTBF) equal to or greater than 2000 hours (SSS410) [SSDD880], with an objective system reliability of 3000 hours. (SSS410) [SSDD881]

The TCS components shall be capable of operating continuously without failure for a minimum of 72 hours.

4.7 Safety, Security, and Privacy

Links that provide communications between the TCS and other systems shall be secured in a manner appropriate for the sensitivities of the material passed through such links, in accordance with DoD Directive C-5200.5, "Communication Security (COMSEC)" dated 21 April 1990. (SSS365)[SSDD882]

The TCS design shall consider all safety requirements affecting design and performance except nuclear safety. (SSS345)[SSDD883]

The TCS shall comply with para 5.3 of MIL-STD 882C, "System Safety Program Requirements", dated 19 January 1993 w/ Notice 1 dated 19 January 1996. (SSS346)[SSDD884]

The TCS design shall provide protection against injury to TCS operators and maintenance personnel. (SSS357)[SSDD885]

The TCS system design shall use MIL-STD-2036, Section 5.1.3.11 as a guide, with regard to personnel hazards, and MIL-STD-1472D, Section 5.13, as a guide for safety from a human engineering viewpoint. (SSS358)[SSDD886]

System safety and health hazards, if any, shall be identified and evaluated during Phase I of the TCS development. (SSS359)[SSDD887]

The TCS shall enable the performance of all maintenance actions with safety and comparative ease by providing adequate access to all equipment components and minimizing the requirements for special tools and test equipment. (SSS412) [SSDD888]

4.8 Logistics

Support for the TCS shall be in accordance with the Integrated Logistical Support Plan (ILSP) and the maintenance concepts and policies of the individual Services. (SSS504) [SSDD889]

TCS transport and storage containers shall be reusable and enable the operators to set-up equipment within the established timelines in their ORDs. (SSS505) [SSDD890]

The TCS shall adhere to DOD regulations and policy governing military standards for logistics, Petroleum, Oil and Lubricants (POL), tools, Test, Measurement, and Diagnostic Equipment (TMDE), tools, and other support items. (SSS506) [SSDD891]

A TCS support and fielding package shall be developed and available for operational testing. (SSS510) [SSDD892]

The TCS shall meet the deployment criteria for the organic unit to which it is assigned. (SSS516) [SSDD1009]

The TCS shall be transported into the theater as an organic component of the operational UAV system being deployed. (SSS517) [SSDD1010]

TCS transportation in theater for Army and Marine Corps systems shall be by ground, air, as well as rail transportable. (SSS518) [SSDD1011]

For the Air Force, TCS transportation to the theater shall be by air. (SSS519) [SSDD1012] Within the theater, the USAF GCS shall be capable of being moved around an established airfield. (SSS520) [SSDD1013]

The TCS shall be ground transportable. (SSS521) [SSDD1014]

The TCS shall be ground transportable. (SSS523) [SSDD1015]

The TCS shall be rail transportable. (SSS524) [SSDD1016]

The TCS shall be configurable for sea, ground, as well as air transport in 2 hours or less. (SSS525) [SSDD1017]

The TCS system shall be capable of being de-configured from sea, ground, as well as air transport and ground-mobile in 2 hours or less. (SSS526) [SSDD1018]

4.9 Maintenance

The TPM on a non-interference basis shall not exceed 1 hour per day. (SSS413) [SSDD893]
Preventative Maintenance (PM) on an interference basis shall be acceptable, but shall not exceed 1 hour per week. (SSS413) [SSDD894]

The TCS maintainability will be considered in every phase of the design and development process. The TCS threshold maintainability (Mean Time To Repair (MTTR)) shall be equal to or less than 1.9 hours (SSS411) [SSDD895], with an objective maintainability that shall be equal to or less than 1 hour. (SSS411) [SSDD896]

Standard tools, TMDE, repair parts, and lubricants shall be used to maintain the TCS. Exceptions shall be considered on a case by case basis. (SSS507) [SSDD897]

Tools and test equipment required to maintain the TCS but not resident in each service inventory shall be identified as special tools and special purpose test equipment (SPTE), respectively, and kept to a minimum. (SSS513) [SSDD1019]

Each Service shall support the TCS as part of the UAV system, which is organic to them. (SSS508) [SSDD898]

The TCS shall be maintained in accordance with the UAV ORD for that Service and the Level Of Repair Analysis (LORA) for the hardware chosen. (SSS509) [SSDD899]

The TCS shall be maintained in accordance with Services' approved UAV maintenance concepts and procedures. (SSS511) [SSDD900]

To the maximum extent possible, general purpose test equipment (GPTE) and common tools resident in each service shall be used to perform all corrective and preventative maintenance at all authorized levels of maintenance. (SSS512) [SSDD901]

4.10 Documentation

All TCS Operator Manuals and Technical Manuals shall be verified and validated prior to initial operational test. (SSS529) [SSDD902]

System requirement and interface documentation shall be developed as part of the TCS program and will follow MIL-STD-498 for format. (SSS427) [SSDD903] Technical and Operator Manuals will follow the Technical Manual Contract Requirements (TMCR).

The documentation developed shall contain sufficient level of detail to identify the functional, operational and design requirements of the TCS. (SSS428) [SSDD904]

The documentation shall contain sufficient technical detail to define the hardware and software design implemented to satisfy the system requirements. (SSS429) [SSDD905]

The TCS documentation shall include: (SSS430) [SSDD906]

- 1) The TCS System/Subsystem Specification (SSS)

- 2) The TCS System/Subsystem Design Document (SSDD)
- 3) The TCS Software Requirements Specification (SRS) (1 for each CSCI)
- 4) The Software Design Document (SDD) (1 for each CSCI)
- 5) The TCS Hardware Design Document (HDD)
- 6) Interface Design Document (IDD) for all interfaces
- 7) TCS Version Description Document(s) (VDD)

5.0 Requirements Traceability

5.1 TCS SSDD to TCS SSS Requirement Cross Rreference

Table 5.1-1 TCS SSDD to TCS SSS Requirements Cross Reference

5.2 TCS SSS to TCS SSDD Requirement Cross Rreference

Table 5.2-1 TCS SSS to TCS SSDD Requirements Cross Reference

6.0 Notes

Acronym List

Term..... Definition

| | |
|-----------------------|---|
| Ao | Availability |
| ACCS | Army Command & Control System Message Catalog |
| ACS..... | Aerial Common Sensor |
| ADOCS..... | Automated Deep Operations Coordination System |
| ADT | Air Data Terminal |
| AFATDS..... | Advanced Field Artillery Tactical Data System |
| AFMSS | Air Force Mission Support System |
| AIS | Automated Information System |
| ARITA | Airborne Reconnaissance Information Technical Architecture |
| ASAS | All Source Analysis System |
| ASD | Assistant Secretary of Defense |
| ATHS..... | Automated Target Hand-off System |
| ATWCS | Advanced Tactical Weapons Control System |
| AV..... | Air Vehicle |
| BITE..... | Built In Test Equipment |
| C3I | Command, Control, Communications, and Intelligence |
| C ⁴ I..... | Command, Control, Communication, Computer, and Intelligence |
| CARS..... | Contingency Airborne Reconnaissance System |
| CCTV..... | Closed Circuit Television |
| CDR | Critical Design Review |
| CGS..... | Common Ground Station |
| CIG/SS..... | Common Imagery Ground/Surface System |
| COE | Common Operating Environment |
| COMPSS..... | Common Operational Modeling, Planning, and Simulation System |
| CONOPS..... | Concept of Operation |
| COSIP | Computer Open Systems Interface Processor |
| CSC..... | Computer Software Component |
| CSU..... | Computer Software Unit |
| DARO | Defense Airborne Reconnaissance Office |
| DCM | Data Control Module |
| DD..... | Dahlgren Division |
| DII..... | Defense Information Infrastructure |
| DII/COE..... | Defense Information Infrastructure/Common Operating Environment |
| DoD..... | Department of Defense |
| DoDI | Department of Defense Instruction |
| DS | Data Server |
| EMI | Electromagnetic Interference |
| EO/IR..... | Electro-optical/Infrared |
| ETRAC | Enhanced TRAC (Tactical Radar Correlator) |
| EW | Electronic Warfare |
| FDDI..... | Fiber-Distributed Data Interface |
| FD/L..... | Fault Detection/Location |
| FIPS | Federal Information Processing Standard |

| | |
|--------------|---|
| GCS..... | Ground Control Station |
| GPS | Global Positioning System |
| GPTE | General Purpose Test Equipment |
| GSM..... | Ground Station Module |
| GUI | graphical User Interface |
| HAE | High Altitude Endurance |
| HCI..... | Human-Computer Interface |
| HDD..... | Hardware Design Document |
| HERO..... | Hazards of Electromagnetic Radiation to Ordnance |
| HF | High Frequency |
| HMMWV..... | High Mobility Multi-purpose Wheeled Vehicle |
| HRU | Hardcopy reconstruction unit |
| | High resolution unit |
| HWCIIs | Hardware Configuration Items |
| HWPS | Hardware Performance Specification |
| IAS | Intelligence Analysis System |
| IAW | In Accordance With |
| IBLS | Integrity Beacon Landing System |
| IDD | Interface Design Description |
| IDT..... | Integrated Data Control |
| IFF..... | Identification Friend or Foe |
| IFR | Instrument Flight Rules |
| ILSDS | Integrated Logistics Support Design Specification |
| ILSP | Integrated Logistics Support Plan |
| I/O | Input/Output |
| IPF..... | Integrated Processing Facility |
| IRS | Interface Requirements Specifications |
| JDISS | Joint Deployable Intelligence Support System |
| JII | Joint Interoperability Interface |
| JMCIS | Joint Maritime Command Information System |
| JMF..... | Joint Message Format |
| JSIPS..... | Joint Service Imagery Processing System |
| JSIPS-N..... | Joint Service Imagery Processing System – Navy |
| JSTARS | Joint Surveillance Target Attack Radar System |
| JTA | Joint Technical Architecture |
| JTC/SIL..... | Joint Technology Center/System Integration Laboratory |
| LAN | Local Area Network |
| LORA..... | Level of Repair Analysis |
| LRIP..... | Low Rate Initial Production |
| LSA..... | Logistic Support Analysis |
| LSAR | Logistic Support Analysis Record |
| MAE | Medium Altitude Endurance (UAV) |
| MIES | Modernized Imagery Exploitation System |
| MSE | Mobile Subscriber Equipment |
| MTBF | Mean Time Between Failure |
| MTTR | Mean Time To Repair |
| MUSE | Multiple UAV Simulation Environment |
| NDI | Non-Developmental Items |
| NITF..... | National Imagery Transmission Format |
| NIST..... | National Intelligence Support Team |

| | |
|----------------|---|
| NRT | Non Real Time |
| NSWCDD | Naval Surface Warfare Center Dahlgren Division |
| ORD | Operational Requirements Document |
| PEO | Program Executive Office |
| POL | Petroleum, Oil, Lubricants |
| PM | Program Manager |
| | Preventative Maintenance |
| PTW | Precision Targeting Workstation |
| RADHAZ | Radiation Hazard |
| RTP | Remote Tape Processor |
| | Real Time Processor |
| SAR | Synthetic Aperture Radar |
| SATCOM | Satellite Communications |
| SDD | Software Design Document |
| SGI | Silicon Graphics Inc |
| SINCGARS | Single Channel Ground and Airborne Radio System |
| SPIRIT | Special Purpose Integrated Remote Intelligence Terminal |
| SPTE | Special Purpose Test Equipment |
| SRS | Software Requirements Specification |
| SSDD | System/Subsystem Design Document |
| SSS | System / Subsystem Specification |
| TAMPS | Tactical Aircraft Mission Planning System |
| TBD | To Be Determined |
| TBMCS | Theatre Battle Management Core System |
| TCDL | Tactical Common Data Link |
| TCIM | Tactical Communication Interface Module |
| TCS | Tactical Control System |
| TEG | Tactical Exploitation Group |
| TMCR | Technical Manual Contract Requirement |
| TMDE | Test, Measurement, and Diagnostic Equipment |
| TPM | Total Preventative Maintenance |
| TRR | Technical Readiness Review |
| TUAV | Tactical Unmanned Aerial Vehicle |
| UAV | Unmanned Aerial Vehicle |
| UCARS | UAV Common Automated Recovery System |
| UHF | Ultra High Frequency |
| USMTF | United States Message Text Format |
| VDD | Version Description Document |
| VHF | Very High Frequency |
| VMF | Variable Message Format |

APPENDIX A TCS-LS (LANDBASED SHELTER-MOUNTED) SYSTEM

Only sections containing information specific to the TCS-LS system are shown in Appendix A.

A3 TCS-LS System Wide Design Decisions

The primary function for the TCS is to provide command and control of the payload, AV, datalink, and other necessary support equipment in order to employ tactical UAVs to conduct reconnaissance, surveillance, target acquisition, and target identification missions. The TCS will interface with, and export/disseminate payload data to supported military units via external (not part of TCS) tactical communications systems, and C4I systems. Communications procedures, formats, and interfaces will be interoperable with selected standard DoD C4I systems, architectures, and protocols.

A3.4 Design and Construction Choices

The TCS-LS will be installed in HMMWV shelter with power supplied by diesel driven generators or commercial power sources providing 110V at 60Hz.

The TCS components shall be capable of operation in environments expected within the land-based shelter. (SSS372) [SSDD1020]

As shown in Figure A3.4-1, the TCS-LS is comprised of the following core elements: two (2) Non-Real Time Computer HWCIs, two (2) Video Support HWCIs, two (2) Operator Output HWCIs, two (2) Operator Input HWCIs, TBD Real Time Computer HWCI(s), TBD Manual Controls HWCI(s), TBD Integrated Datalink Terminal HWCI(s), TBD Ku Datalink Terminal HWCI(s), TBD C-Band Line Of Site Antenna Assembly HWCI(s), TBD Ku-Band SATCOM Antenna Assembly HWCI(s), TBD IBLs HWCI(s), TBD UCARS HWCI(s), configuration dependent number and type of DCM HWCI(s), one(1) TCS Printer HWCI, TBD External Storage HWCI, TBD SAR Payload equipment, and two (2) copies of the TCS CSCIs. For TCS-LS applications requiring less than level 5 interaction, refer to Table 4.3-1.

The TCS-LS will also contain the following unique HWCIs: TCS-LS Shelter HWCI, C4I Support Equipment HWCI, Communications Equipment HWCI, Intercom Equipment HWCI, Uninterruptible Power Supply HWCI, and Power Distribution HWCI.

The TCS-LS Communication Equipment will include, but not limited to, any combination of the following: VHF Radio, UHF Radio, HF Radio, VHF/UHF Radio, SATCOM Radio, MSE, DSVT, and TBD additional Communication Equipment.

Each TCS will support both a LOS datalink and a Ku datalink. The TCS-LS, which includes two TCSs, will support a minimum of four Datalink Terminals.

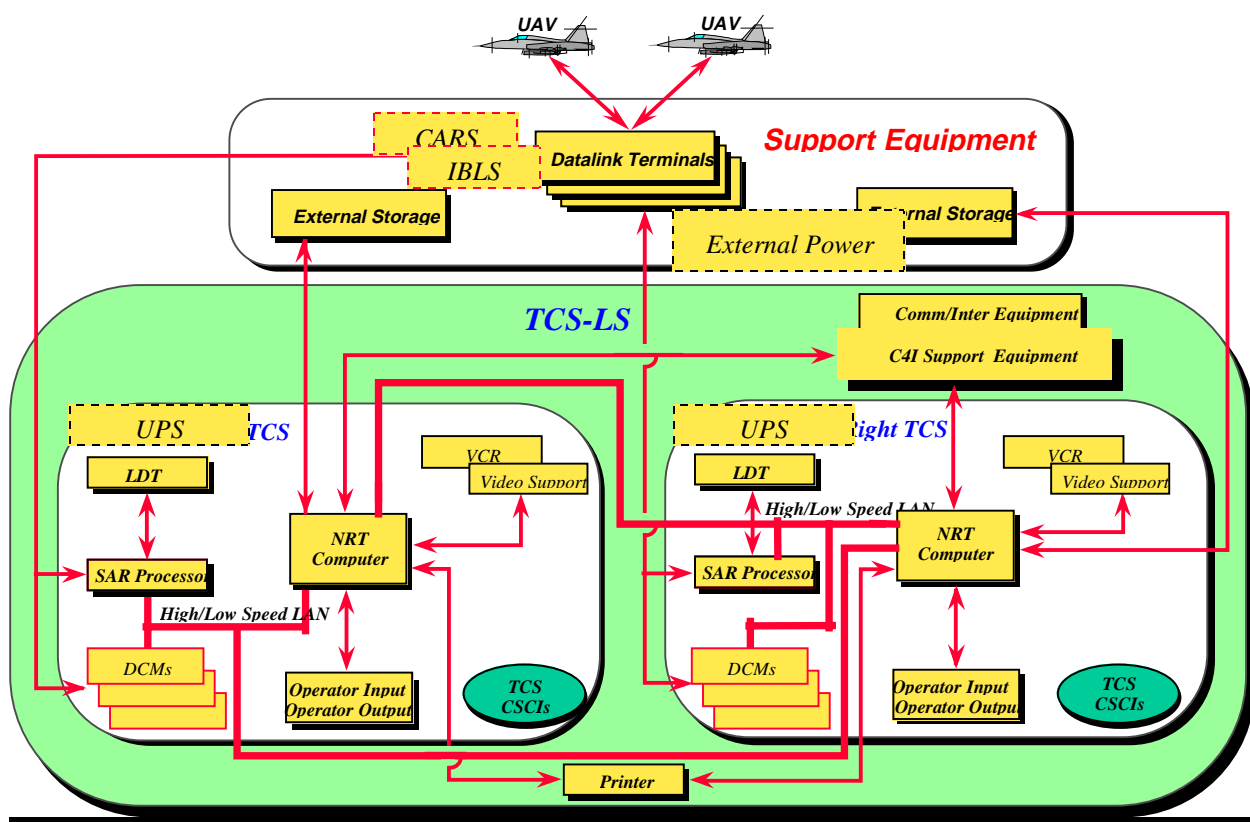


Figure A3.2-1 TCS-LS

A4.2.6.1.5.1 MSE Equipment HWCI

The purpose of the MSE is to provide a corps level and below common-user system which provides secure, long-range communications to subordinate divisions, adjacent units, joint and allied services, and the Defense Information Systems Network (DISN). MSE consists of a network of LOS multi-channel radios and interconnected local and long distance switching nodes which provide wide area communications coverage and network access points and facilities to battlefield commanders and staffs. MSE is the backbone of the Corps' and Division's communications systems and provides voice and data communications from the corps rear boundary forward to the division maneuver battalion's main and rear Command Posts (CPs).

The major items of MSE equipment are integrated into six functional areas: Subscriber Terminals, Mobile Subscriber Access, Wire Subscriber Access, Area Coverage, System Control, Packet Network.

The MSE shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD907]

A4.2.6.1.5.2 UHF/VHF Radio HWCI

The UHF/VHF Radio shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD908]

A4.2.6.1.5.3 KY-68 HWCI

The KY-68 shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD909]

A4.2.6.1.5.4 UHF radio(s) HWCI

The UHF Radio shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD910]

A4.2.6.1.5.5 HF radio(s) HWCI

The HF Radio shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD911]

A4.2.6.1.5.6 VHF radio(s) HWCI

The VHF Radio shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD912]

A4.2.6.1.5.7 Digital Secure Voice Terminal HWCI

The DSVT shall be capable of providing the results of its periodic FD/L. (SSS249) [SSDD913]

A4.2.7.1.2.1 TCS-LS Power Distribution HWCI

The TCS-LS shall provide a circuit breaker panel. (SSS533) [SSDD914] The circuit breaker panel shall be designed to provide a safe operating environment for the TCS operator(s), and provide sufficient circuit protection of the TCS equipment. (SSS357) [SSDD915]

The TCS-LS Circuit Breaker shall send Common UAV Control CSCI the results of its periodic FD/L if applicable. (SSS249) [SSDD916]

A4.2.8.1 TCS-LS Shelter HWCI

The shelter shall be of military ruggedized and hardened to EMP shielding and easily mounted on a HMMWV. (SSS533) [SSDD917] It shall not inhibit roll on, roll off of a C130 aircraft. (SSS522) [SSDD918] It shall provide workstation space allocation for two soldier/operator workstations. (SSS533) [SSDD919] Cable routing and lighting provision shall be provided for future growth and networking. (SSS533) [SSDD920] Ground provisions shall be easily implemented for power distribution and operation in arid areas. (SSS533) [SSDD921] The shelter shall meet all the lighting and crew equipment storage requirements of MIL-STD-1472. (SSS533) [SSDD922] Provisions for climate control (air conditioning and heating), low level IR signature interior lighting, water provisions for length of mission shifts, storage for war fighting equipment, weapons, MOPP IV gear shall be made. (SSS533) [SSDD923] Also, provisions for positive pressure CBR environmental protection shall be implemented. (SSS533) [SSDD924] The shelter shall provide limited storage for spare parts critical to mission operation. (SSS533) [SSDD925] It shall provide a workstation space meeting all the requirements for operation by two soldier/operators for the TCS. (SSS443) [SSDD926] The shelter shall have roof access suitable for operator access wearing cold region footwear. (SSS533) [SSDD927] Time to emplace shall not exceed 30 minutes. (SSS533) [SSDD928] The TCS shelter shall be emplaceable on terrain slopes not exceeding 20 degrees. (SSS533) [SSDD929] It shall provide shelves necessary for mounting communication and data processing equipment. (SSS533) [SSDD930] The shelter shall allocate space for embedded training equipment, location of tape/disc(s) and easy access to manuals for training and maintenance operations. (SSS533) [SSDD931] For situations where shelter power will be provided from the HMMWV battery, shelter demand shall not drain the battery power below cranking voltages. (SSS533) [SSDD932]

A4.2.8.1.1 TCS-LS External Connectors Panel HWCI

The TCS-LS shall have an external power panel to receive cables from the power generator. (SSS319) [SSDD933] The external power shall be pre-conditioned by passing it through an Electromagnetic Interference (EMI) filter and a surge protector. (SSS434) [SSDD934] The power shall then be routed through the main circuit breaker. (SSS357) [SSDD935]

The TCS-LS shall have an I/O panel to receive interconnect cables from peripheral equipment. (SSS533) [SSDD936] The external I/O panel interfaces shall include, but not be limited to, the following peripheral equipment:

- LOS Datalink Terminal TBD
- Ku Band SATCOM Terminal TBD
- C4I TBD
- Landline Communications TBD
- Long Distance Communications TBD

A4.3.1 Flow of Execution Control

During travel to the operational site, or TCS set up, voice channel communication shall be used as the primary means of communication. (SSS533) [SSDD937] While setting up, the TCS shall be in a pre-operation state during which only radio communications may be sent and received. (SSS533) [SSDD938]

A4.3.1.1 Normal Operations Mode Execution

The TCS-LS shall allow operators to sub-divide in any manner these activities of execution between all TCSs connected together, nominally two TCSs, for one to four AVs as illustrated in figure A4.3.1.1-1. (SSS533) [SSDD939]

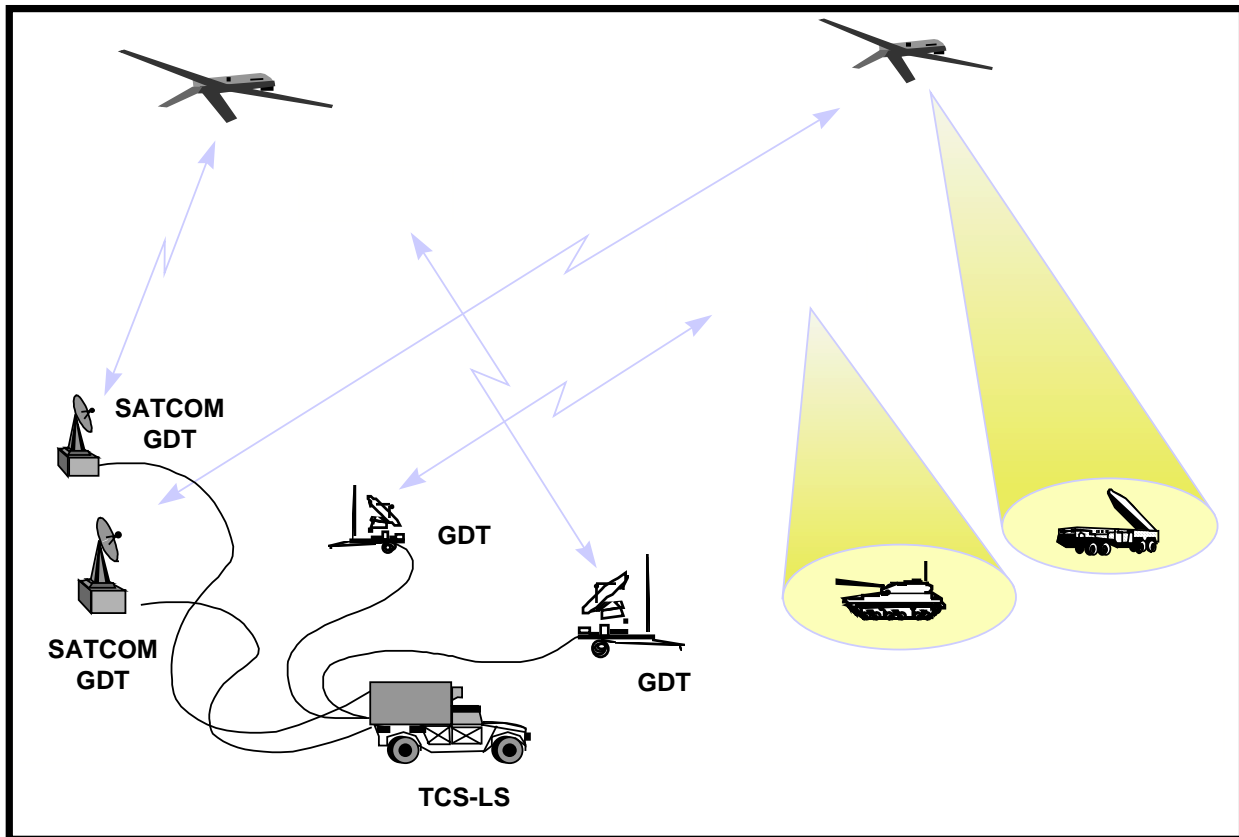


Figure A4.3.1.1-1 Tactical Scenario Illustrating TCS-LS Controlling Four AVs

A4.4.1.1.3 Hardware to Hardware Interfaces

1. NRT Computer to External Interface Panel
2. External Interface Panel to External Printer
3. External Interface Panel to External Storage
4. NRT Computer to Operator Output and Operator Input
5. Circuit Breaker Panel to External Interface Panel
6. DCMs (specify each TBD) to External Interface Panel
7. External Interface Panel to Datalink Terminals (specify each TBD)
8. External Interface Panel to UCARS
9. External Interface Panel to IBLs
10. External Interface Panel to SAR Processor
11. NRT Computer to C4I Support Equipment
12. C4I Support Equipment to KY-68
13. KY-68 to MSE Communication Equipment
14. KY-68 to VHF Radios
15. KY-68 to UHF Radios
16. KY-68 to HF Radios

17. KY-68 to UHF/VHF Radios
18. Digital Secure Voice Terminal to VHF Radios
19. Digital Secure Voice Terminal to UHF Radios
20. Digital Secure Voice Terminal to HF Radios
21. Digital Secure Voice Terminal to UHF/VHF Radios
22. Digital Secure Voice Terminal to MSE Communication Equipment
23. Communication Equipment to External Interface Panel
24. UCARS Equipment to External Interface Panel
25. IBLIS Equipment to External Interface Panel
26. TBD additional interfaces

A4.4.1.2.2 Power Interfaces

1. Intercom Equipment to Circuit Breaker Panel
2. UHF Radios to Circuit Breaker Panel
3. VHF Radios to Circuit Breaker Panel
4. HF Radios to Circuit Breaker Panel
5. UHF/VHF Radios to Circuit Breaker Panel
6. MSE Equipment to Circuit Breaker Panel
7. KY-68 to Circuit Breaker Panel
8. Digital Secure Voice Terminal to Circuit Breaker Panel
9. External Interface Panel to External Power
10. Environmental Control Equipment to Circuit Breaker Panel
11. External Interface Panel to Antennas
12. Video Support to External Interface Panel
13. SAR Processor to Circuit Breaker Panel
14. NRT Computer to UPS
15. UPS to Circuit Breaker Panel
16. VCR to Circuit Breaker Panel
17. Printer to Circuit Breaker Panel
18. Circuit Breaker Panel to External Interface Panel
19. External Interface Panel to Datalink Terminals
20. TBD additional interfaces

A4.4.2.1.3 Hardware to Hardware Interface Characteristics

A4.4.2.1.3.1 Non-Real Time Computer to C4I Support Equipment

The Non-Real Time Computer HWCI shall have a connection to the C4I Support Equipment to allow for the transmission of information to standard DoD tactical radios. (SSS214) [SSDD940]

The Non-Real Time Computer HWCI shall have a connection to the C4I Support Equipment to allow for the transmission of information to external mission tasking systems. (SSS209) [SSDD941]

A4.4.2.1.3.23 Non-Real Time Computer to External Interface Panel

A physical interface shall exist between the Non-Real Time Computer HWCI and the External Interface Panel HWCI. (SSS533) [SSDD942]

A4.4.2.1.3.24 External Interface Panel to External Printer

A physical interface shall exist between the External Interface Panel HWCI and the Printer HWCI. (SSS533) [SSDD943]

A4.4.2.1.3.25 External Interface Panel to External Storage

The External Interface Panel shall have a physical interface to External Storage HWCIs. (SSS533) [SSDD944]

A4.4.2.1.3.28 DCMs to External Interface Panel

The DCM HWCIs and External Interface Panel shall be connected by a physical interface in order to send and receive all required information to and from the AV. (SSS533) [SSDD945]

A4.4.2.1.3.29 External Interface Panel to Datalink Terminals

The External Interface Panel HWCI and the Datalink Terminal(s) shall be connected by a physical interface in order to send and receive all required information to and from the AV. (SSS533) [SSDD946]

A4.4.2.1.3.33 C4I Support Equipment to KY-68

The TCS C4I Support shall have a connection to the KY-68 to allow for the transmission of information to standard DoD tactical radios. (SSS407) [SSDD947]

The TCS C4I Support shall have a connection to the KY-68 to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD948]

The TCS C4I Support shall have a connection to the KY-68 to allow for the transmission to the following C4I systems:

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)
3. Army Deep Operations Coordination System (ADOCS)
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)
11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)

15. Service Mission Planners
16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS)
(SSS365) [SSDD949]

A4.4.2.1.3.34 KY-68 to MSE Communication Equipment

The KY-68 HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS365) [SSDD950]

The KY-68 HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD951]

A4.4.2.1.3.35 KY-68 to VHF Radios

The KY-68 HWCI shall have a connection to the VHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS365) [SSDD952]

The KY-68 HWCI shall have a connection to the VHF Radios HWCI to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD953]

A4.4.2.1.3.36 KY-68 to UHF Radios

The KY-68 HWCI shall have a connection to the UHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS365) [SSDD954]

The KY-68 HWCI shall have a connection to the UHF Radios HWCI to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD955]

A4.4.2.1.3.37 KY-68 to HF Radios

The KY-68 HWCI shall have a connection to the HF Radios HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS365) [SSDD956]

The KY-68 HWCI shall have a connection to the HF Radios HWCI to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD957]

A4.4.2.1.3.38 KY-68 to UHF/VHF Radios

The KY-68 HWCI shall have a connection to the UHF/VHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS365) [SSDD958]

The KY-68 HWCI shall have a connection to the UHF/VHF Radios HWCI to allow for the transmission of information to external mission tasking systems. (SSS365) [SSDD959]

A4.4.2.1.3.39 Digital Secure Voice Terminal to VHF Radios

The DSVT HWCI shall have a connection to the VHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS214) [SSDD960]

The DSVT HWCI shall have a connection to the VHF Radio HWCI to allow for the transmission of information to external mission tasking systems. (SSS214) [SSDD961]

A4.4.2.1.3.40 Digital Secure Voice Terminal to UHF Radios

The DSVT HWCI shall have a connection to the UHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS214) [SSDD962]

The DSVT HWCI shall have a connection to the UHF Radio HWCI to allow for the transmission of information to external mission tasking systems. (SSS214) [SSDD963]

A4.4.2.1.3.41 Digital Secure Voice Terminal to HF Radios

The DSVT HWCI shall have a connection to the HF Radio HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS214) [SSDD964]

The DSVT HWCI shall have a connection to the HF Radio HWCI to allow for the transmission of information to external mission tasking systems. (SSS214) [SSDD965]

A4.4.2.1.3.42 Digital Secure Voice Terminal to UHF/VHF Radios

The DSVT HWCI shall have a connection to the UHF/VHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS214) [SSDD966]

The DSVT HWCI shall have a connection to the UHF/VHF Radio HWCI to allow for the transmission of information to external mission tasking systems. (SSS214) [SSDD967]

A4.4.2.1.3.43 Digital Secure Voice Terminal to MSE Communication Equipment

The DSVT HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to MSE equipment. (SSS407) [SSDD968]

The DSVT HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to external mission tasking systems. (SSS407) [SSDD969]

A4.4.2.1.3.44 Communication Equipment to External Interface Panel

The Communication Equipment HWCI shall have a connection to the External Interface Panel HWCI to allow for the transmission of information to standard DoD tactical radios. (SSS533) [SSDD970]

The Communication Equipment HWCI shall have a connection to the External Interface Panel HWCI to allow for the transmission of information to external mission tasking systems. (SSS533) [SSDD971]

A4.4.2.1.3.45 UCARS Equipment to External Interface Panel

The UCARS recovery system shall connect to the External Interface Panel in order to send and receive recovery system information to the TCS via the High/Low LAN. (SSS533) [SSDD972]

A4.4.2.1.3.46 IBLs Equipment to External Interface Panel

The IBLs launch and recovery system shall connect to the External Interface Panel in order to send and receive recovery system information to the TCS via the High/Low LAN. (SSS533) [SSDD973]

A4.4.2.2.2.4 Intercom Equipment to Circuit Breaker Panel

The Intercom Equipment shall physically connect to the Circuit Breaker Panel. (SSS357)

[SSDD974]

A4.4.2.2.2.5 UHF Radios to Circuit Breaker Panel

The UHF Radios shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD975]

A4.4.2.2.2.6 VHF Radios to Circuit Breaker Panel

The VHF Radios shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD976]

A4.4.2.2.2.7 HF Radios to Circuit Breaker Panel

The HF Radios shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD977]

A4.4.2.2.2.8 UHF/VHF Radios to Circuit Breaker Panel

The UHF/VHF Radios shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD978]

A4.4.2.2.2.9 MSE Equipment to Circuit Breaker Panel

The MSE Equipment shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD979]

A4.4.2.2.2.10 KY-68 to Circuit Breaker Panel

The KY-68 shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD980]

A4.4.2.2.2.11 Digital Secure Voice Terminal to Circuit Breaker Panel

The DSVT shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD981]

A4.4.2.2.2.12 External Interface Panel to External Power

The External Interface Panel shall physically connect to a standard power supply. (SSS357) [SSDD982]

A4.4.2.2.2.13 Environmental Control Equipment to Circuit Breaker Panel

The Environmental Control Equipment shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD983]

A4.4.2.2.2.15 Video Support to External Interface Panel

The Video Support Equipment shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD984]

A4.4.2.2.2.16 SAR Processor to Circuit Breaker Panel

The SAR Processor shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD985]

A4.4.2.2.2.17 Digital Linear Tape Drive to Circuit Breaker Panel

The Digital Linear Tape Drive shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD986]

A4.4.2.2.2.18 NRT Computer to UPS

The NRT Computer HWCI shall have an interface to an uninterruptible power supply. (SSS357) [SSDD987]

A4.4.2.2.2.19 UPS to Circuit Breaker Panel

The UPS shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD988]

A4.4.2.2.2.20 VCR to Circuit Breaker Panel

The VCR shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD989]

A4.4.2.2.2.21 Printer to Circuit Breaker Panel

The Internal Printer shall physically connect to the Circuit Breaker Panel. (SSS357) [SSDD990]

A4.4.2.2.2.22 Circuit Breaker Panel to External Interface Panel

The Circuit Breaker Panel shall physically connect to the External Interface Panel. (SSS533) [SSDD991]

A4.4.2.2.2.23 External Interface Panel to Datalink Terminals

The External Interface Panel shall physically connect to all Datalink Terminals operating with the TCS-LS. (SSS533) [SSDD992]

A4.4.2.2.2.24 External Interface Panel to Geopositional Data

The TCS-LS shall have an interface to a source of current navigation information. (SSS321) [SSDD1021] As a minimum this information will include the location of all data terminals, launch and recovery sites, and the controlling TCS.

APPENDIX B TCS-SB (SHIPBOARD) SYSTEM

Only sections containing information specific to the TCS-SB system are shown in Appendix B.

B3 TCS-SB System Wide Design Decisions

The primary function for the TCS is to provide command and control of the payload, AV, datalink, and other necessary support equipment in order to employ tactical UAVs to conduct reconnaissance, surveillance, target acquisition, and target identification missions. The TCS will interface with and export/disseminate payload data to supported military units via external (not part of TCS) tactical communications systems, and C4I systems. Communications procedures, formats, and interfaces will be interoperable with selected standard DoD C4I systems, architectures, and protocols.

B3.4 Design and Construction Choices

The TCS-SB will be installed on-board Navy Ships and Boats with power supplied by internal ship's power providing 110V at 60Hz.

The TCS software will reside on the Tactical Advanced Computer (TAC) series of computers utilizing the HP-UNIX operating system.

The TCS components shall be capable of operation in environments expected within the shipboard environment. (SSS372) [SSDD1022]

As shown in Figure B3.4-1, the TCS-SB is comprised of the following elements: two (2) Non-Real Time Computer HWCIs, two (2) Video Support HWCIs, Two (2) SAR Processor HWCIs, the required Datalink Terminal HWCIs, and two (2) copies of the TCS CSCIs. The TCS-SB also contains the following unique equipment: TCS Printer HWCI, MSE, Communication Equipment HWCI, the Uninterruptible Power Supply HWCI, two (2) External Data Storage HWCIs, the UCARS HWCI, and the IBLS HWCI. The TCS will support a maximum of four Datalink Terminals (DTs). The Datalink Terminals will consist of a mixture of one or more of the following units: a Predator Ground Data Terminal (PGDT), Outrider Ground Data Terminal (OGDT), SATCOM Ground Data Terminal, Pioneer Ground Data Terminal (PiGDT). For TCS-SB applications requiring only level 1 interaction, no DT is required.

(Make SB diagram and associated text reflect a single TCS configuration with respect to HWCI/CSCI)

Individual ship configurations may consist of multiple TCSs.

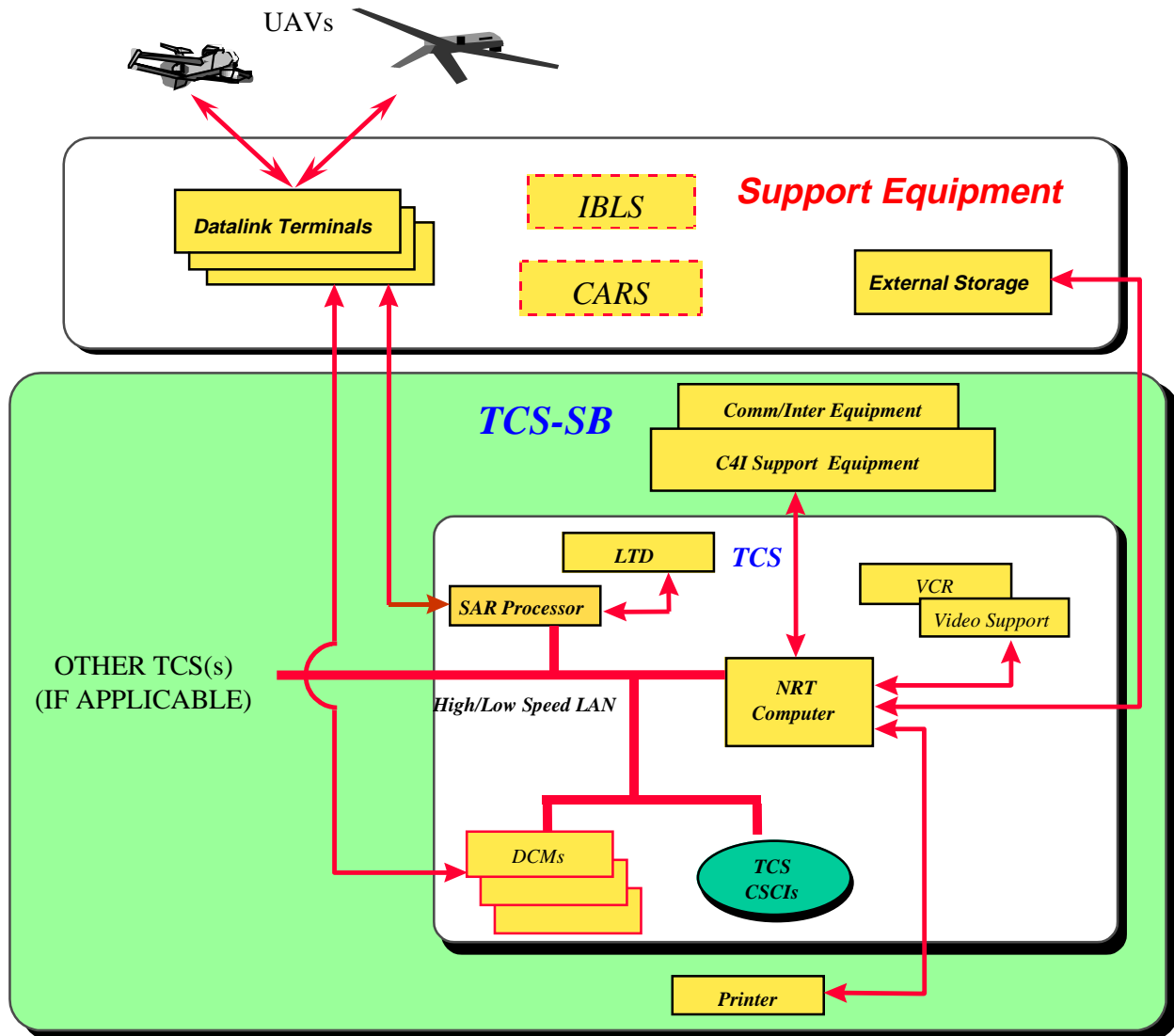


Figure B3.4-1 TCS-SB Configuration

B4.2.5.2.1.5 Datalink Management and Control

For shipboard operations, the Common UAV Control CSCI shall provide the capability to control automatic switching to a second LOS antenna, if a second antenna is available, when the currently active antenna is masked by shipboard obstructions. (SSS116) [SSDD993]

B4.2.6.1.3 Intercom Equipment HWCI

The TCS shall utilize internal shipboard communication systems that allow the operator(s) of the TCS to verbally communicate with each other. (SSS534) [SSDD994]

B4.4.1 TCS Interface Identification

The following interfaces are defined for the TCS-SB configuration:

B4.4.2.2.1 UPS to External Power Interface Characteristics

The UPS shall physically connect to and operate with shipboard power sources. (SSS319) [SSS995]

B4.4.2.2.2 TCS to Geopositional Data

The TCS-SB shall have an interface to a source of current navigation information. (SSS321) [SSDD1023] As a minimum this information will include the location of all data terminals, launch and recovery sites, and the controlling TCS.